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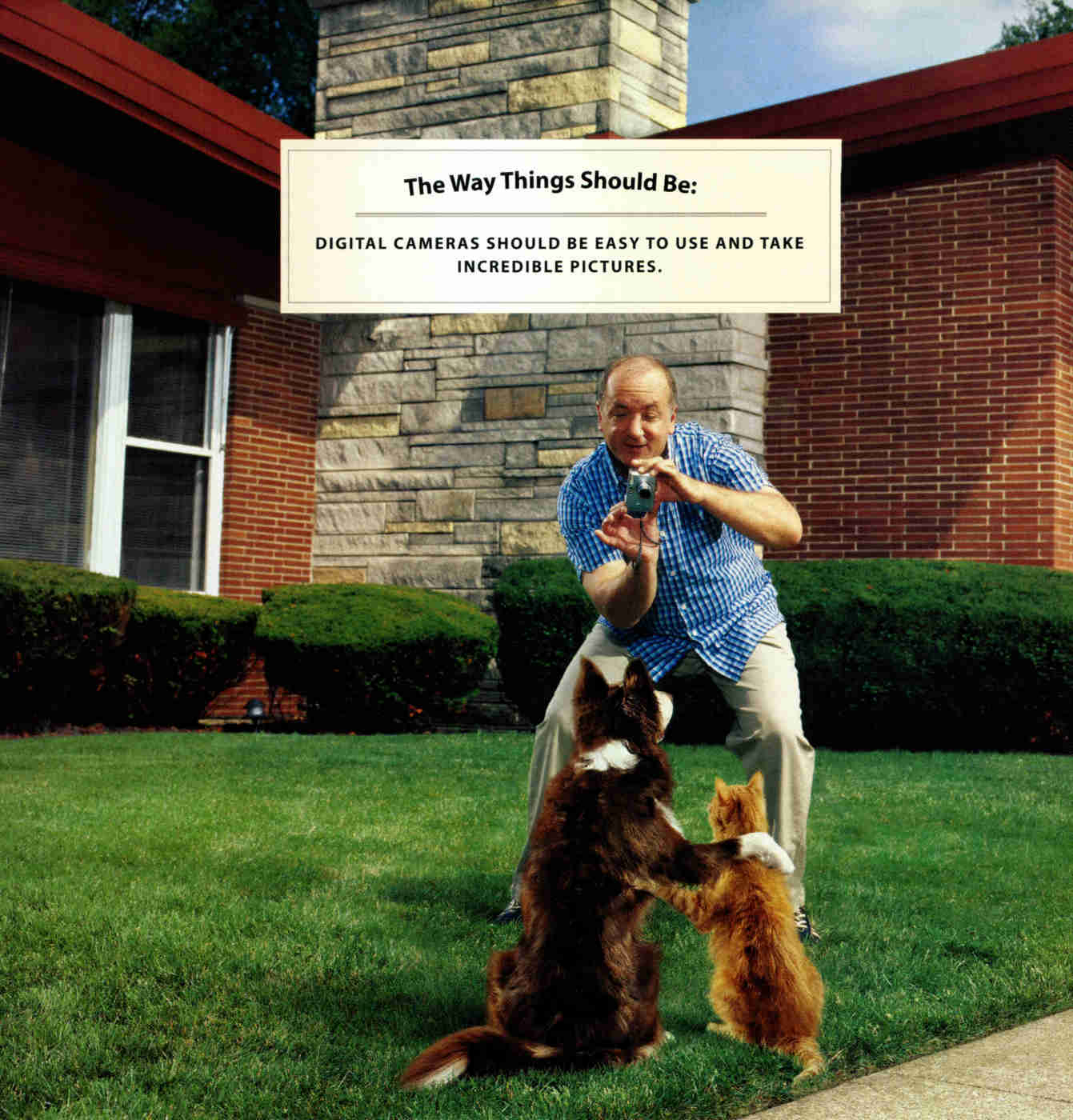
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THE COVER

Prince Mishaal bin Abdul Aziz of Saudi Arabia performs a ritual sword dance to conclude a camel festival.

BY REZA

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or just turn out the lights and go home?

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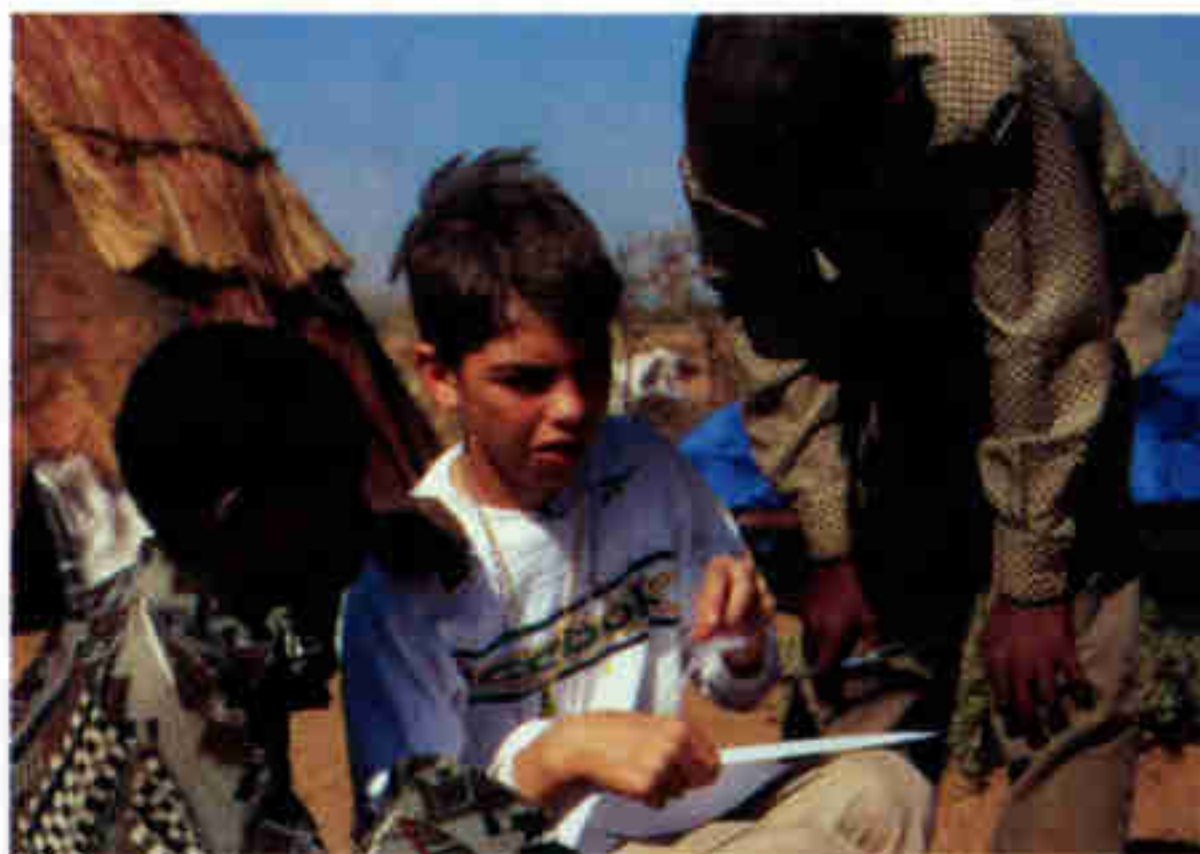
National Geographic Channel

**PREMIERES MONDAY, OCT. 6,
8 P.M. ET/PT**

Worlds Apart

Take a typical American family, transplant them to a remote village in Kenya (right), India, or Ghana, and watch what happens. This 13-part reality series presents the trials and triumphs of families as they deal with exotic foods, customs, and ways of looking at the world. For the season premiere,

a Virginia family moves to a fishing village in Papua New Guinea and learns to live like the neighbors—with canoes for transportation, huts for homes, and a steady diet of fish and yams.



**NATIONAL GEOGRAPHIC CHANNEL,
SATURDAY, OCT. 25, 6 P.M. ET, 3 P.M. PT**

Through the Lens

Leap out of an airplane (left), swim with sharks, or descend into the crater of an active volcano with nine adventure photographers as they describe what they go through to get that one "killer shot."



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**MONDAYS, 9 P.M.
ET/PT**

Taboo

What's forbidden or strange in one culture is often part of everyday life in another. The second season of *Taboo* features a Berber marriage market, the witches of Ghana, full-body tattoos, and a stew of culinary delights from goat fetus to ram's eyeballs.

Channel and NGT&F programming information accurate at press time; consult local listings or the Society's website at nationalgeographic.com

NG Television & Film

**NATIONAL GEOGRAPHIC ULTIMATE EXPLORER,
MSNBC, SUNDAY, OCTOBER 26, 8 P.M. ET/PT**

Creepy Healers

What has three jaws, 300 teeth, and wants to suck your blood? It's naturalist Nick Baker's favorite invertebrate: the European medicinal leech. Baker visits hospitals and a leech farm to learn how this creature, so popular with ancient healers, is back on the cutting edge of medicine. He also looks at the miracles maggots work with serious wounds, and how they help forensic experts crack cases.



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Q&A WITH AN ORANGUTAN EXPERT

ASK CHERYL KNOTT Post your questions for the author of this month's story (page 76). ■ **BIO AND RESOURCES** Learn more about Cheryl and these endangered apes. nationalgeographic.com/ngm/0310

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Fighting Back with Aricept®



*I love my life way too much
to just hand it over to Alzheimer's.*

*When my memory started failing,
I knew I had to see my doctor. He put
me on ARICEPT®. Now I'm doing better.**

If a person forgets names, places or facts – and has trouble with everyday things like reading or shopping – it may not be normal aging. It could be Alzheimer's disease. So it's important to see a doctor as soon as you can.

There is no cure for Alzheimer's. But a prescription drug called ARICEPT® has been used by millions of people to help their symptoms.

In studies, ARICEPT® has been proven to work for mild to moderate Alzheimer's. It has helped people improve their memory over time. It has also helped them to keep doing everyday things on their own, longer.

Ask your doctor if ARICEPT® is right for you or your loved one. It is the #1 prescribed drug for Alzheimer's in the world. The sooner you know it's Alzheimer's, the sooner ARICEPT® can help.

ONCE-A-DAY
ARICEPT®
(donepezil HCl)
5-MG AND 10-MG TABLETS

Strength in the face of Alzheimer's™

To learn more and to receive
a memory checklist,
call 800-760-6029 ext.55
or visit www.aricept.com



ARICEPT® is well tolerated but may not be for everyone. Some people may experience nausea, diarrhea, not sleeping well, vomiting, muscle cramps, feeling very tired, or not wanting to eat. In studies, these side effects were usually mild and went away over time. Some people taking ARICEPT® may experience fainting. People at risk for ulcers should tell their doctors because their condition may get worse.

Please see additional important product information on accompanying page.

*Individual responses to ARICEPT® can be different – people may get better, stay the same or not get better.

ONCE-A-DAY

ARICEPT (donepezil HCl)

3-MG AND 10-MG TABLETS

STRENGTH IN THE FACE OF ALZHEIMER'S™

ARICEPT® (Donepezil Hydrochloride Tablets)
Brief Summary—see package insert for full prescribing information. **INDICATIONS AND USAGE** ARICEPT® is indicated for the treatment of mild to moderate dementia of the Alzheimer's type. **CONTRAINDICATIONS** ARICEPT® is contraindicated in patients with known hypersensitivity to donepezil hydrochloride or to piperidine derivatives. **WARNINGS** **Anesthesia:** ARICEPT®, as a cholinesterase inhibitor, is likely to exaggerate succinylcholine-type muscle relaxation during anesthesia. **Cardiovascular Conditions:** Because of their pharmacological action, cholinesterase inhibitors may have vagotonic effects on the sinoatrial and atrioventricular nodes. This effect may manifest as bradycardia or heart block in patients both with and without known underlying cardiac conduction abnormalities. Syncopal episodes have been reported in association with the use of ARICEPT®. **Gastrointestinal Conditions:** Through their primary action, cholinesterase inhibitors may be expected to increase gastric acid secretion due to increased cholinergic activity. Therefore, patients should be monitored closely for symptoms of active or occult gastrointestinal bleeding, especially those at increased risk for developing ulcers, e.g., those with a history of ulcer disease or those receiving concurrent nonsteroidal anti-inflammatory drugs (NSAIDs). Clinical studies of ARICEPT® have shown no increase, relative to placebo, in the incidence of either peptic ulcer disease or gastrointestinal bleeding. ARICEPT®, as a predictable consequence of its pharmacological properties, has been shown to produce diarrhea, nausea and vomiting. These effects, when they occur, appear more frequently with the 10 mg/day dose than with the 5 mg/day dose. In most cases, these effects have been mild and transient, sometimes lasting one to three weeks, and have resolved during continued use of ARICEPT®. **Genitourinary:** Although not observed in clinical trials of ARICEPT®, cholinomimetics may cause bladder outflow obstruction. **Neurological Conditions:** Seizures: Cholinomimetics are believed to have some potential to cause generalized convulsions. However, seizure activity also may be a manifestation of Alzheimer's Disease. **Pulmonary Conditions:** Because of their cholinomimetic actions, cholinesterase inhibitors should be prescribed with care to patients with a history of asthma or obstructive pulmonary disease. **PRECAUTIONS** **Drug-Drug Interactions** **Drugs Highly Bound to Plasma Proteins:** Drug displacement studies have been performed *in vitro* between this highly bound drug (96%) and other drugs such as furosemide, digoxin, and warfarin. ARICEPT® at concentrations of 0.3-10 µg/mL did not affect the binding of furosemide (5 µg/mL), digoxin (2 ng/mL), and warfarin (3 µg/mL) to human albumin. Similarly, the binding of ARICEPT® to human albumin was not affected by furosemide, digoxin, and warfarin. **Effect of ARICEPT® on the Metabolism of Other Drugs:** No *in vivo* clinical trials have investigated the effect of ARICEPT® on the clearance of drugs metabolized by CYP 3A4 (e.g., cisapride, terfenadine) or by CYP 2D6 (e.g., imipramine). However, *in vitro* studies show a low rate of binding to these enzymes (mean K_i about 50-130 µM), that, given the therapeutic plasma concentrations of donepezil (164 nM), indicates little likelihood of interference. Whether ARICEPT® has any potential for enzyme induction is not known. **Effect of Other Drugs on the Metabolism of ARICEPT®:** Ketoconazole and quinidine, inhibitors of CYP450, 3A4 and 2D6, respectively, inhibit donepezil metabolism *in vitro*. Whether there is a clinical effect of these inhibitors is not known. Inducers of CYP 2D6 and CYP 3A4 (e.g., phenytoin, carbamazepine, dexamethasone, rifampin, and phenobarbital) could increase the rate of elimination of ARICEPT®. **Use with Anticholinergics:** Because of their mechanism of action, cholinesterase inhibitors have the potential to interfere with the activity of anticholinergic medications. **Use with Cholinomimetics and Other Cholinesterase Inhibitors:** A synergistic effect may be expected when cholinesterase inhibitors are given concurrently with succinylcholine, similar neuromuscular blocking agents or cholinergic agonists such as bethanechol. **Carcinogenesis, Mutagenesis, Impairment of Fertility** Carcinogenicity studies of donepezil have not been completed. Donepezil was not mutagenic in the Ames reverse mutation assay in bacteria. In the chromosome aberration test in cultures of Chinese hamster lung (CHL) cells, some clastogenic effects were observed. Donepezil was not clastogenic in the *in vivo* mouse micronucleus test. Donepezil had no effect on fertility in rats at doses up to 10 mg/kg/day (approximately 8 times the maximum recommended human dose on a mg/m² basis). **Pregnancy** **Pregnancy Category C:** Teratology studies conducted in pregnant rats at doses up to 16 mg/kg/day (approximately 13 times the maximum recommended human dose on a mg/m² basis) and in pregnant rabbits at doses up to 10 mg/kg/day (approximately 16 times the maximum recommended human dose on a mg/m² basis) did not disclose any evidence for a teratogenic potential of donepezil. However, in a study in which pregnant rats were given up to 10 mg/kg/day (approximately 8 times the maximum recommended human dose on a mg/m² basis) from day 17 of gestation through day 20 postpartum, there was a slight increase in still births and a slight decrease in pup survival through day 4 postpartum at this dose; the next lower dose tested was 3 mg/kg/day. There are no adequate or well-controlled studies in pregnant women. ARICEPT® should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus. **Nursing Mothers** It is not known whether donepezil is excreted in human breast milk. ARICEPT® has no indication for use in nursing mothers. **Pediatric Use** There are no adequate and well-controlled trials to document the safety and efficacy of ARICEPT® in any illness occurring in children. **ADVERSE REACTIONS** **Adverse Events Leading to Discontinuation** The rates of discontinuation from controlled clinical trials of ARICEPT® due to adverse events for the ARICEPT® 5 mg/day treatment groups were comparable to those of placebo-treatment groups at approximately 5%. The rate of discontinuation of patients who received 7-day escalations from 5 mg/day to 10 mg/day, was higher at 13%. The most common adverse events leading to discontinuation, defined as those occurring in at least 2% of patients and at twice the incidence seen in placebo patients, are shown in Table 1.

| Table 1. Most Frequent Adverse Events Leading to Withdrawal from Controlled Clinical Trials by Dose Group | | | |
|---|---------|-------------------|--------------------|
| Dose Group | Placebo | 5 mg/day ARICEPT® | 10 mg/day ARICEPT® |
| Patients Randomized | 355 | 350 | 315 |
| Event/% Discontinuing | | | |
| Nausea | 1% | 1% | 3% |
| Diarrhea | 0% | <1% | 3% |
| Vomiting | <1% | <1% | 2% |

Most Frequent Adverse Clinical Events Seen in Association with the Use of ARICEPT®
The most common adverse events, defined as those occurring at a frequency of at least 5% in patients receiving 10 mg/day and twice the placebo rate, are largely predicted by ARICEPT®'s cholinomimetic effects. These include nausea, diarrhea, insomnia, vomiting, muscle cramp, fatigue and anorexia. These adverse events were often of mild intensity and transient, resolving during continued ARICEPT® treatment without the need for dose modification. There is evidence to suggest that the frequency of these common adverse events may be affected by the rate of titration. An open-label study was conducted with 269 patients who received placebo in the 15- and 30-week studies. These patients were titrated to a dose of 10 mg/day over a 6-week period. The rates of common adverse events were lower than those seen in patients titrated to 10 mg/day over one week in the controlled clinical trials and were comparable to those seen in patients on 5 mg/day. See Table 2 for a comparison of the most common adverse events following one and six week titration regimens.

| Table 2. Comparison of Rates of Adverse Events in Patients Titrated to 10 mg/day Over 1 and 6 Weeks | | | | |
|---|-----------------|------------------|--------------------|--------------------|
| Adverse Event | No titration | | One-week titration | Six-week titration |
| | Placebo (n=315) | 5 mg/day (n=311) | 10 mg/day (n=315) | 10 mg/day (n=269) |
| Nausea | 6% | 5% | 19% | 6% |
| Diarrhea | 5% | 8% | 15% | 9% |
| Insomnia | 6% | 6% | 14% | 6% |
| Fatigue | 3% | 4% | 8% | 3% |
| Vomiting | 3% | 3% | 8% | 5% |
| Muscle cramps | 2% | 6% | 8% | 3% |
| Anorexia | 2% | 3% | 7% | 3% |

Adverse Events Reported in Controlled Trials The events cited reflect experience gained under closely monitored conditions of clinical trials in a highly selected patient population. In actual clinical

practice or in other clinical trials, these frequency estimates may not apply, as the conditions of use, reporting behavior, and the kinds of patients treated may differ. Table 3 lists treatment emergent signs and symptoms that were reported in at least 2% of patients in placebo-controlled trials who received ARICEPT® and for which the rate of occurrence was greater for ARICEPT® assigned than placebo assigned patients. In general, adverse events occurred more frequently in female patients and with advancing age.

Table 3. Adverse Events Reported in Controlled Clinical Trials in at Least 2% of Patients Receiving ARICEPT® (donepezil HCl) and at a Higher Frequency than Placebo-treated Patients

| Body System/Adverse Event | Placebo (n=355) | ARICEPT® (n=747) |
|---|-----------------|------------------|
| Percent of Patients with any Adverse Event | 72 | 74 |
| Body as a Whole | | |
| Headache | 9 | 10 |
| Pain, various locations | 8 | 9 |
| Accident | 6 | 7 |
| Fatigue | 3 | 5 |
| Cardiovascular System | | |
| Syncope | 1 | 2 |
| Digestive System | | |
| Nausea | 6 | 11 |
| Diarrhea | 5 | 10 |
| Vomiting | 3 | 5 |
| Anorexia | 2 | 4 |
| Hemic and Lymphatic System | | |
| Ecchymosis | 3 | 4 |
| Metabolic and Nutritional Systems | | |
| Weight Decrease | 1 | 3 |
| Musculoskeletal System | | |
| Muscle Cramps | 2 | 6 |
| Arthritis | 1 | 2 |
| Nervous System | | |
| Insomnia | 6 | 9 |
| Dizziness | 6 | 8 |
| Depression | <1 | 3 |
| Abnormal Dreams | 0 | 3 |
| Somnolence | <1 | 2 |
| Urogenital System | | |
| Frequent Urination | 1 | 2 |

Other Adverse Events Observed During Clinical Trials ARICEPT® has been administered to over 1700 individuals during clinical trials worldwide. Approximately 1200 of these patients have been treated for at least 3 months and more than 1000 patients have been treated for at least 6 months. Controlled and uncontrolled trials in the United States included approximately 900 patients. In regards to the highest dose of 10 mg/day, this population includes 650 patients treated for 3 months, 475 patients treated for 6 months and 116 patients treated for over 1 year. The range of patient exposure is from 1 to 1214 days. Treatment emergent signs and symptoms that occurred during 3 controlled clinical trials and two open-label trials in the United States were recorded as adverse events by the clinical investigators using terminology of their own choosing. To provide an overall estimate of the proportion of individuals having similar types of events, the events were grouped into a smaller number of standardized categories using a modified COSTART dictionary and event frequencies were calculated across all studies. These categories are used in the listing below. The frequencies represent the proportion of 900 patients from these trials who experienced that event while receiving ARICEPT®. All adverse events occurring at least twice are included, except for those already listed in Tables 2 or 3. COSTART terms too general to be informative, or events less likely to be drug caused. Events are classified by body system and listed using the following definitions: **frequent adverse events**—those occurring in at least 1/100 patients; **infrequent adverse events**—those occurring in 1/100 to 1/1000 patients. These adverse events are not necessarily related to ARICEPT® treatment and in most cases were observed at a similar frequency in placebo-treated patients in the controlled studies. No important additional adverse events were seen in studies conducted outside the United States. **Body as a Whole:** *Frequent:* influenza, chest pain, toothache; *Infrequent:* fever, edema face, periorbital edema, hernia hiatal, abscess, cellulitis, chills, generalized coldness, head fullness, listlessness. **Cardiovascular System:** *Frequent:* hypertension, vasodilation, atrial fibrillation, hot flashes, hypotension; *Infrequent:* angina pectoris, postural hypotension, myocardial infarction, AV block (first degree), congestive heart failure, arteritis, bradycardia, peripheral vascular disease, supraventricular tachycardia, deep vein thrombosis. **Digestive System:** *Frequent:* fecal incontinence, gastrointestinal bleeding, bloating, epigastric pain; *Infrequent:* eructation, gingivitis, increased appetite, flatulence, periodontal abscess, cholelithiasis, diverticulitis, drooling, dry mouth, fever sore, gastritis, irritable colon, tongue edema, epigastric distress, gastroenteritis, increased transaminases, hemorrhoids, ileus, increased thirst, jaundice, melena, polydipsia, duodenal ulcer, stomach ulcer. **Endocrine System:** *Infrequent:* diabetes mellitus, goiter. **Hemic and Lymphatic System:** *Infrequent:* anemia, thrombocytopenia, thrombocytopenia, eosinophilia, erythrocytopenia. **Metabolic and Nutritional Disorders:** *Frequent:* dehydration; *Infrequent:* gout, hypokalemia, increased creatine kinase, hyperglycemia, weight increase, increased lactate dehydrogenase. **Musculoskeletal System:** *Frequent:* bone fracture; *Infrequent:* muscle weakness, muscle fasciculation. **Nervous System:** *Frequent:* delusions, tremor, irritability, paresthesia, aggression, vertigo, ataxia, increased libido, restlessness, abnormal crying, nervousness, aphasia; *Infrequent:* cerebrovascular accident, intracranial hemorrhage, transient ischemic attack, emotional lability, neuralgia, coldness (localized), muscle spasm, dysphoria, gait abnormality, hypertonia, hypokinesia, neurodermatitis, numbness (localized), paranoia, dysarthria, dysphasia, hostility, decreased libido, melancholia, emotional withdrawal, nystagmus, pacing. **Respiratory System:** *Frequent:* dyspnea, sore throat, bronchitis; *Infrequent:* epistaxis, post nasal drip, pneumonia, hyperventilation, pulmonary congestion, wheezing, hypoxia, pharyngitis, pleurisy, pulmonary collapse, sleep apnea, snoring. **Skin and Appendages:** *Frequent:* pruritus, diaphoresis, urticaria; *Infrequent:* dermatitis, erythema, skin discoloration, hyperkeratosis, alopecia, fungal dermatitis, herpes zoster, hirsutism, skin striae, night sweats, skin ulcer. **Special Senses:** *Frequent:* cataract, eye irritation, vision blurred; *Infrequent:* dry eyes, glaucoma, earache, tinnitus, blepharitis, decreased hearing, retinal hemorrhage, otitis externa, otitis media, bad taste, conjunctival hemorrhage, ear buzzing, motion sickness, spots before eyes. **Urogenital System:** *Frequent:* urinary incontinence, nocturia; *Infrequent:* dysuria, hematuria, urinary urgency, melorrhagia, cystitis, enuresis, prostate hypertrophy, pyelonephritis, inability to empty bladder, breast fibroadenosis, fibrocystic breast, mastitis, pyuria, renal failure, vaginitis. **Postintroduction Reports** Voluntary reports of adverse events temporally associated with ARICEPT® that have been received since market introduction that are not listed above, and that there is inadequate data to determine the causal relationship with the drug include the following: abdominal pain, agitation, cholecystitis, confusion, convulsions, hallucinations, heart block (all types), hemolytic anemia, hepatitis, hyponatremia, neuroleptic malignant syndrome, pancreatitis, and rash. **OVERDOSAGE** **Because strategies for the management of overdose are continually evolving, it is advisable to contact a Poison Control Center to determine the latest recommendations for the management of an overdose of any drug.** As in any case of overdose, general supportive measures should be utilized. Overdosage with cholinesterase inhibitors can result in cholinergic crisis characterized by severe nausea, vomiting, salivation, sweating, bradycardia, hypotension, respiratory depression, collapse and convulsions. Increasing muscle weakness is a possibility and may result in death if respiratory muscles are involved. Tertiary anticholinergics such as atropine may be used as an antidote for ARICEPT® overdosage. Intravenous atropine sulfate titrated to effect is recommended: an initial dose of 1.0 to 2.0 mg IV with subsequent doses based upon clinical response. Atypical responses in blood pressure and heart rate have been reported with other cholinomimetics when co-administered with quaternary anticholinergics such as glycopyrrrolate. It is not known whether ARICEPT® and/or its metabolites can be removed by dialysis (hemodialysis, peritoneal dialysis, or hemofiltration). Dose-related signs of toxicity in animals included reduced spontaneous movement, prone position, staggering gait, lacrimation, clonic convulsions, depressed respiration, salivation, miosis, tremors, fasciculation and lower body surface temperature.

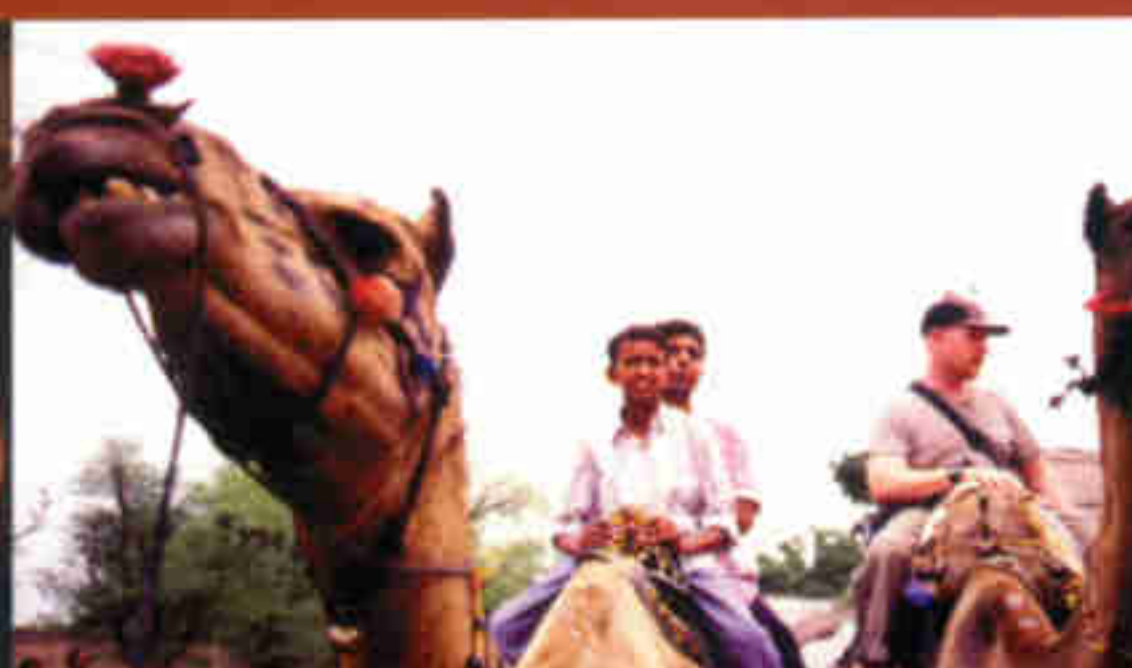
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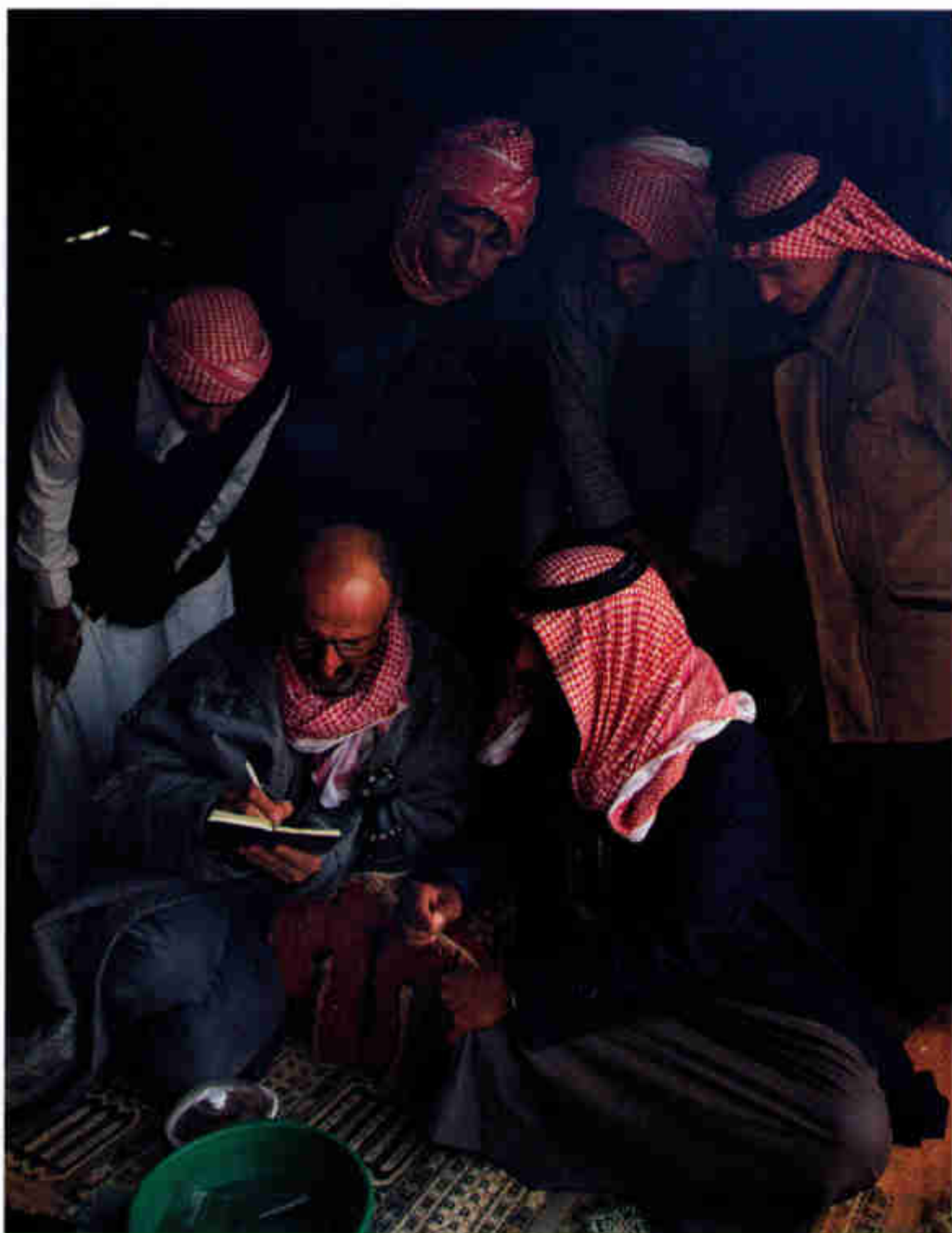
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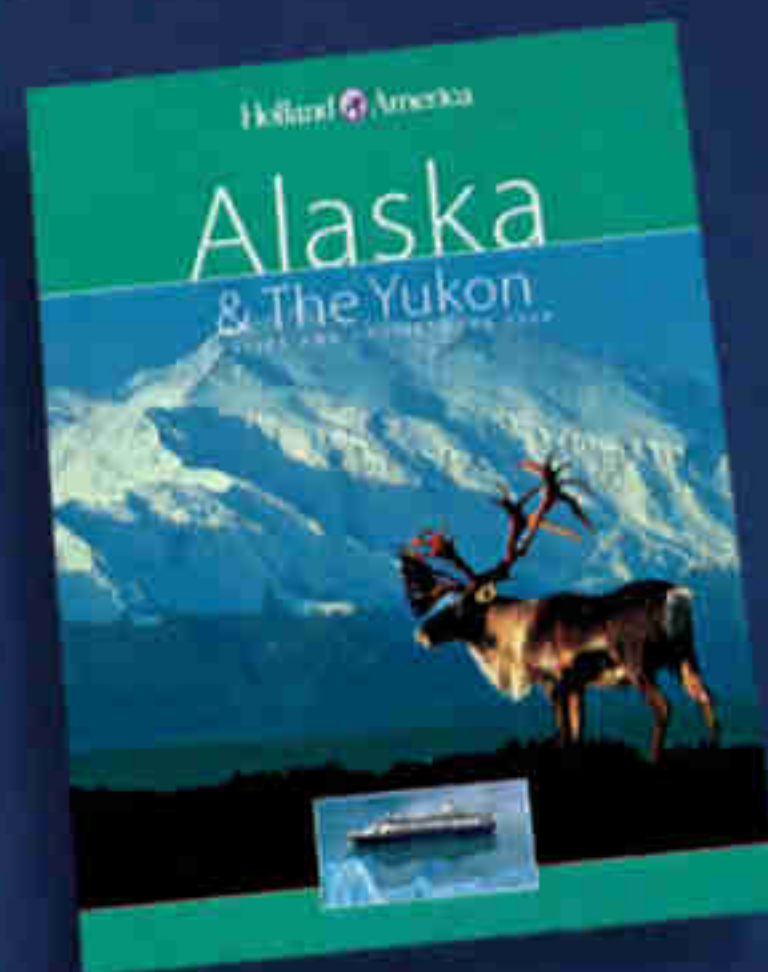
SAUDI ARABIA. What do those words bring to mind? An ocean of sand? Oil? Mecca? Al Qaeda? If you're like many Westerners, that pretty much sums it up.

But I'm hoping this month's cover story will change all that. You may recall that in December 2001 we ran a landmark story on Abraham, the biblical patriarch revered by Muslims, Christians, and Jews. Coming just a few months after 9/11, that story—with photos by longtime contributor Reza (above, transcribing poetry with Saudi tribesmen)—reminded us all of the rich spiritual tradition that Islam shares with the West. It also opened a rare window of opportunity for the magazine. Following up leads generated by Reza's Abraham coverage in Mecca, we won access for Reza and author Frank Viviano to travel extensively throughout Saudi Arabia, epicenter of the Muslim world and one of the most closed societies on Earth. Their story, which begins on page 2, is essential reading for those who won't settle for stereotypes.

Bill Allen

■ Watch my preview of the November issue on **National Geographic Today** on October 17 at 7 p.m. and again at 10 p.m. (ET and PT) on the National Geographic Channel.

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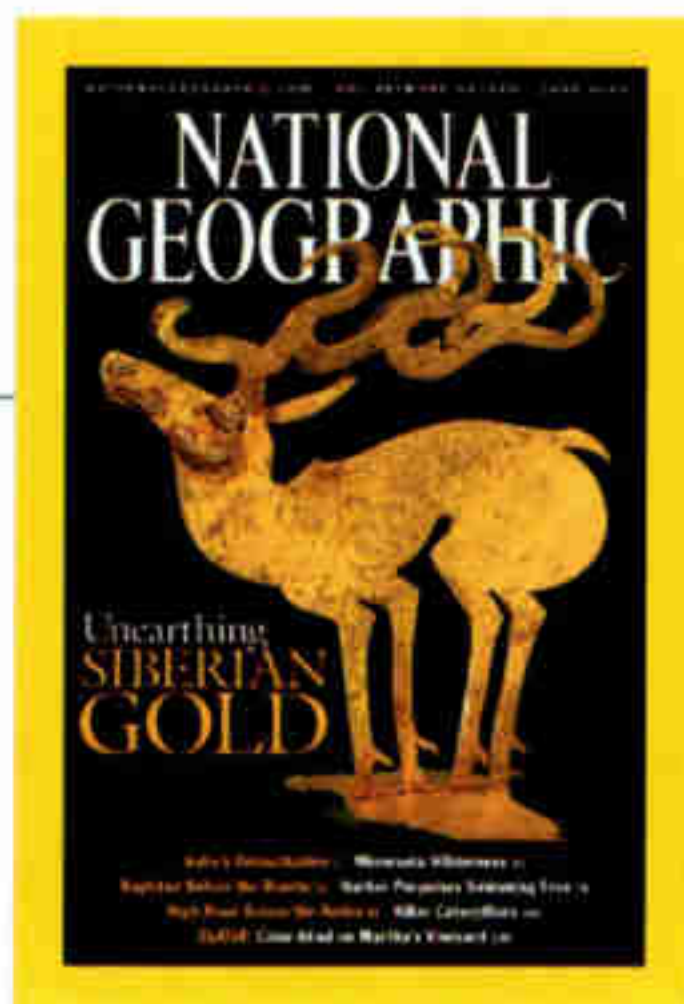
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Forum

June 2003

For a magazine filled with photography, the GEOGRAPHIC usually doesn't get a lot of mail about photographs. But June's pictures set off a few sparks: Bill Allard's images of *Untouchables* inspired an inquiry about adopting a little girl and offers of help for a man disfigured by acid, while Jim Brandenburg's photos of Minnesota's Boundary Waters triggered a small debate (see next page).



India's Untouchables

I thought there could not be anything else that would shock me about man's cruelty to his fellow man. I see that I was sorely wrong.

SAM MARKS
Amelia Island, Florida

Tom O'Neill describes a Brahman who snubs the lower classes. This Brahman's fundamentalist view of Hindu life does not necessarily reflect accurately the beliefs revealed in the Vedas (Hindu sacred texts) or the beliefs upheld by most Indians. Ask a swami (a teacher of Hindu philosophy) what he thinks about Untouchability, and he will tell you that he abhors it. In recent years, journalists have duped Westerners into believing that Islam is a religion of violence, misogyny, and intolerance. These journalists only focus on fundamentalist interpretations.

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O'Neill has made a similar mistake in his radical depiction of Hindu philosophy. Such mistakes promote divisions that have proved incredibly detrimental to world peace.

JOHN-MICHAEL PARTESSOTI
New Orleans, Louisiana

We Indians take great pride in saying we are the largest democracy in the world, but we continue to deny human rights to these unfortunate people. If Indians want to become a part of the civilized world, we must not allow the scourge of Untouchability to exist.

PATRE S. RAJASHEKHAR
Bangalore, India

This article uses Untouchability as a tool to make yet another attack on a country from which the West has taken so much and given back so little. A country that has suffered from centuries of imperialist exploitation, with a population of a billion plus, will need time to change.

RAJIV NAG
State College, Pennsylvania

As an Indian and a Hindu, I found myself burning in embarrassment as I read your article. The root of the problem lies in



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Boundary Waters Photos: Gorgeous or Greeting Cards?

Whatever in the blue-eyed world gave you the idea that NATIONAL GEOGRAPHIC readers like artsy, out-of-focus photographs?

JOSIAH MANNING
Aurora, Missouri

Being both a photographer and a graphic designer, I was mesmerized by the composition and color of Jim Brandenburg's photography. His keen eye and sense of his surroundings created a delightful visual trip I shall take again and again.

FRED KIRBY
Porter, Texas

I am absolutely astounded that you would allow such poorly

conceived and imaged photos into your magazine. Pictures such as these would be more at home on a greeting card. I subscribe because NATIONAL GEOGRAPHIC has consistently



JIM BRANDENBURG (ALL)

set the highest standards in the imaging of non-studio photography. I hope this isn't a portent. These images are of substandard resolution and tonality. The colors are disturbingly digital and oversaturated,

and the neutral colors aren't neutral.

KEN HARRIS
New York, New York

Jim Brandenburg's photos are absolutely gorgeous! The pictures mixed the grace and softness of a watercolor with the clarity and sharpness of photography. They took my breath away.

SUSIE MENGELT
Clarkville, Indiana

The spread on pages 40-41 [left] looks like a bunch of mistakes

pasted together. What a strange collection of pictures chosen to represent the physical beauty of the Boundary Waters Canoe Area.

JAMES G. LANDWEHR
Waukesha, Wisconsin

the Indian way of life. We are brought up to obey and never to question. Untouchability has plagued Indians for eons, and it will continue to do so as long as we don't liberate our minds and break free from parochial traditions. Thank you for shedding light on an issue most Indians sweep under the carpet.

JANANIE AUDIMULAM
Muar, Malaysia

I would like to point out that religions do not condemn people. Only people do. As a

matter of fact, the Hindu scripture *Bhagavad Gita* clearly states: "The best person is one who feels the joy and suffering of others as his own because he sees the same soul in all . . . in a Brahman and in an eater-of-dogs." What condemns the poor Untouchables is not religion, but the hypocrisy of so-called high-caste Hindus. These racists are not Hindus.

PRAVIN SASHIDHARAN
Detroit, Michigan

To correct the evil of Untouchability, Indian politicians created another evil: the quota system, which reserves a percentage of positions in educational institutions and jobs in every sector for members of the so-called Untouchable castes. Today, because of these quotas, the dream of many meritorious

Indian students and professionals is to leave the country. And then the country whines about brain drain.

MALIKA TANGIRALA
Reading, Pennsylvania

I am haunted by the photo on page 9 of the worker covered in excrement with what seems to be the hint of a smile on his face. The dignity apparent in this man in the face of his circumstances is remarkable.

STANLEY DOSMAN
Kelowna, British Columbia

Lest we Americans get too disgusted with the practices of Hindu Indians, we would do well to remember the racial injustices that have characterized most of American history: the genocide Europeans perpetrated upon the indigenous people of this land,

WRITE TO FORUM

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WHAT ARE YOU DOING TO HELP PROTECT YOUR HEART?

You do all kinds of things to help safeguard yourself. And yet, if you've had a heart attack or stroke, it's important to ask your doctor if you're doing enough to help protect your heart. The Heart Protection Study by Oxford University, funded in part by Merck, researched ZOCOR.

ZOCOR is the first and only cholesterol medication proven to significantly reduce the risk of heart attack and stroke in people with heart disease. Regardless of cholesterol level.

Before the Heart Protection Study was complete, ZOCOR was a time-tested, cholesterol-lowering medication with over 160 million prescriptions filled in the past 11 years.

Ask your doctor how ZOCOR, along with a healthy diet, can help protect you. Get information about the Heart Protection Study and ZOCOR at zocor.com or call 1-800-MERCK-75.

INFORMATION
ABOUT THE
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ZOCOR
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Important considerations: ZOCOR is a prescription medicine and isn't right for everyone, including women who are nursing or pregnant or who may become pregnant, anyone with liver problems, and people who are allergic to any ingredients of ZOCOR. Unexplained muscle pain or weakness could be a sign of a rare but serious side effect and should be reported to your doctor right away. Your doctor may do blood tests before and during treatment with ZOCOR to check for liver problems. To avoid serious side effects, discuss with your doctor medicine or food you should avoid while on ZOCOR.

YOUR RESULTS MAY VARY.

ASK YOUR DOCTOR IF ZOCOR IS RIGHT FOR YOU.
PLEASE READ THE MORE DETAILED INFORMATION ABOUT ZOCOR
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ZOCOR®

(SIMVASTATIN)

PLEASE READ THIS SUMMARY CAREFULLY, THEN ASK YOUR DOCTOR ABOUT ZOCOR. NO ADVERTISEMENT CAN PROVIDE ALL THE INFORMATION NEEDED TO PRESCRIBE A DRUG. THIS ADVERTISEMENT DOES NOT TAKE THE PLACE OF CAREFUL DISCUSSIONS WITH YOUR DOCTOR. ONLY YOUR DOCTOR HAS THE TRAINING TO WEIGH THE RISKS AND BENEFITS OF A PRESCRIPTION DRUG FOR YOU.

USES OF ZOCOR

ZOCOR is a prescription drug that is indicated as an addition to diet for many patients with high cholesterol. For patients at high risk of coronary heart disease (CHD) because of existing heart disease, diabetes, vascular disease, or history of stroke, ZOCOR is indicated along with diet to reduce the risk of death by reducing coronary death; reduce the risk of heart attack and stroke; and reduce the need for revascularization procedures.

WHEN ZOCOR SHOULD NOT BE USED

Some people should not take ZOCOR. Discuss this with your doctor.

ZOCOR should not be used by patients who are allergic to any of its ingredients. In addition to the active ingredient simvastatin, each tablet contains the following inactive ingredients: cellulose, lactose, magnesium stearate, iron oxides, talc, titanium dioxide, and starch. Butylated hydroxyanisole is added as a preservative.

Patients with liver problems: ZOCOR should not be used by patients with active liver disease or repeated blood test results indicating possible liver problems. (See WARNINGS.)

Women who are or may become pregnant: Pregnant women should not take ZOCOR because it may harm the fetus. **Women of childbearing age should not take ZOCOR unless it is highly unlikely that they will become pregnant.** If a woman does become pregnant while on ZOCOR, she should stop taking the drug and talk to her doctor at once.

Women who are breast-feeding should not take ZOCOR.

WARNINGS

Muscle: Tell your doctor right away if you experience any unexplained muscle pain, tenderness, or weakness at any time during treatment with ZOCOR so your doctor can decide if ZOCOR should be stopped. Some patients may have muscle pain or weakness while taking ZOCOR. Rarely, this can include muscle breakdown resulting in kidney damage. The risk of muscle breakdown is greater in patients taking certain other drugs along with ZOCOR:

- Cyclosporine, itraconazole, ketoconazole, erythromycin, clarithromycin, HIV protease inhibitors, the antidepressant nefazodone, or large quantities of grapefruit juice (>1 quart daily), particularly with higher doses of ZOCOR.
- Gemfibrozil, other fibrates, or lipid-lowering doses (≥ 1 g/day) of niacin, particularly with higher doses of ZOCOR.
- Amiodarone or verapamil with higher doses of ZOCOR.

The risk of muscle breakdown is greater at higher doses of simvastatin.

Because the risk of muscle side effects is greater when ZOCOR is used with the products listed above, the combined use of these products should be avoided unless your doctor determines the benefits are likely to outweigh the increased risks.

If your doctor determines that the benefits of combined use of ZOCOR with gemfibrozil, other fibrates, or niacin likely outweigh the increased risk of muscle problems, the dose of ZOCOR should not exceed 10 mg daily. No more than 10 mg/day of ZOCOR should be taken with cyclosporine.

The combined use of verapamil or amiodarone with doses above ZOCOR 20 mg should be avoided unless your doctor determines the benefits outweigh the increased risk of muscle breakdown.

Your doctor should also carefully monitor for any muscle pain, tenderness, or weakness, particularly during the initial months of therapy and if the dose of either drug is increased. Your doctor also may monitor the level of certain muscle enzymes in your body, but

there is no assurance that such monitoring will prevent the occurrence of severe muscle disease.

The risk of muscle breakdown is greater in patients with kidney problems or diabetes.

If you have conditions that can increase your risk of muscle breakdown, which in turn can cause kidney damage, your doctor should temporarily withhold or stop ZOCOR® (simvastatin). Also, since there are no known adverse consequences of briefly stopping therapy with ZOCOR, treatment should be stopped a few days before elective major surgery and when any major acute medical or surgical condition occurs. Discuss this with your doctor, who can explain these conditions to you.

Liver: About 1% of patients who took ZOCOR in clinical trials developed elevated levels of some liver enzymes. Patients who had these increases usually had no symptoms. Elevated liver enzymes usually returned to normal levels when therapy with ZOCOR was stopped.

In the ZOCOR Survival Study, the number of patients with more than 1 liver enzyme level elevation to greater than 3 times the normal upper limit was no different between the ZOCOR and placebo groups. Only 8 patients on ZOCOR and 5 on placebo discontinued therapy due to elevated liver enzyme levels. Patients were started on 20 mg of ZOCOR, and one third had their dose raised to 40 mg.

Your doctor should perform routine blood tests to check these enzymes before you start treatment with ZOCOR and thereafter when clinically indicated. Patients titrated to the 80-mg dose should receive an additional test at 3 months and periodically thereafter (eg, semiannually) for the first year of treatment. If your enzyme levels increase, your doctor should order more frequent tests. If your liver enzyme levels remain unusually high, your doctor should discontinue your medication.

Tell your doctor about any liver disease you may have had in the past and about how much alcohol you consume. ZOCOR should be used with caution in patients who consume large amounts of alcohol.

PRECAUTIONS

Drug Interactions: Because of possible serious drug interactions, it is important to tell your doctor what other drugs you are taking, including those obtained without a prescription. You should also tell other doctors who are prescribing a new medicine for you that you are taking ZOCOR. ZOCOR can interact with the following:

- Itraconazole
- Ketoconazole
- Erythromycin
- Clarithromycin
- HIV protease inhibitors
- Nefazodone
- Cyclosporine
- Large quantities of grapefruit juice (>1 quart daily)

The risk of myopathy is also increased by the following lipid-lowering drugs that can cause myopathy when given alone:

- Gemfibrozil
- Other fibrates
- Niacin (nicotinic acid) (≥ 1 g/day)

The risk of muscle breakdown is increased with other drugs:

- Amiodarone
- Verapamil

Some patients taking lipid-lowering agents similar to ZOCOR and coumarin anti-coagulants (a type of blood thinner) have experienced bleeding and/or increased blood clotting time. Patients taking these medicines should have their blood tested before starting therapy with ZOCOR and should continue to be monitored.

Central Nervous System Toxicity; Cancer, Mutations, Impairment of Fertility: Like most prescription drugs, ZOCOR was required to be tested on animals before it was marketed for human use. Often these tests were designed to achieve higher drug concentrations than humans achieve at recommended dosing. In some tests, the animals had damage to the nerves in the central nervous system. In studies of mice with high doses of ZOCOR, the likelihood of certain types of cancerous tumors increased. No evidence of mutations or of damage to genetic material has been seen. In 1 study with ZOCOR, there was decreased fertility in male rats.

Pregnancy: Pregnant women should not take ZOCOR because it may harm the fetus.

Safety in pregnancy has not been established. In studies with lipid-lowering agents similar to ZOCOR, there have been rare reports of birth defects of the skeleton and digestive system. Therefore, women of childbearing age should not take

ZOCOR® (simvastatin) unless it is highly unlikely they will become pregnant. If a woman does become pregnant while taking ZOCOR, she should stop taking the drug and talk to her doctor at once. The active ingredient of ZOCOR did not cause birth defects in rats at 3 times the human dose or in rabbits at 3 times the human dose.

Nursing Mothers: Drugs taken by nursing mothers may be present in their breast milk. Because of the potential for serious adverse reactions in nursing infants, a woman taking ZOCOR should not breast-feed. (See WHEN ZOCOR SHOULD NOT BE USED.)

Pediatric Use: ZOCOR is not recommended for children or patients under 10 years of age.

Geriatric Use: Higher blood levels of active drug were seen in elderly patients (70–78 years of age) compared with younger patients (18–30 years of age) in 1 study. In other studies, the cholesterol-lowering effects of ZOCOR were at least as great in elderly patients as in younger patients, and there were no overall differences in safety between elderly and younger patients over the 20–80 mg/day dosage range. Of the 7 cases of myopathy/rhabdomyolysis among 10,269 patients on ZOCOR in another study, 4 were aged 65 or more (at baseline), 1 of whom was over 75.

SIDE EFFECTS

Most patients tolerate treatment with ZOCOR well; however, like all prescription drugs, ZOCOR can cause side effects, and some of them can be serious. Side effects that do occur are usually mild and short-lived. Only your doctor can weigh the risks versus the benefits of any prescription drug. In clinical studies with ZOCOR, less than 1.5% of patients dropped out of the studies because of side effects. In 2 large, 5-year studies, patients taking ZOCOR experienced similar side effects to those patients taking placebo (sugar pills). Some of the side effects that have been reported with ZOCOR or related drugs are listed below. This list is not complete. Be sure to ask your doctor about side effects before taking ZOCOR and to discuss any side effects that occur.

Digestive System: Constipation, diarrhea, upset stomach, gas, heartburn, stomach pain/cramps, anorexia, loss of appetite, nausea, inflammation of the pancreas, hepatitis, jaundice, fatty changes in the liver, and, rarely, severe liver damage and failure, cirrhosis, and liver cancer.

Muscle, Skeletal: Muscle cramps, aches, pain, and weakness; joint pain; muscle breakdown.

Nervous System: Dizziness, headache, insomnia, tingling, memory loss, damage to nerves causing weakness and/or loss of sensation and/or abnormal sensations, anxiety, depression, tremor, loss of balance, psychic disturbances.

Skin: Rash, itching, hair loss, dryness, nodules, discoloration.

Eye/Senses: Blurred vision, altered taste sensation, progression of cataracts, eye muscle weakness.

Hypersensitivity (Allergic) Reactions: On rare occasions, a wide variety of symptoms have been reported to occur either alone or together in groups (referred to as a syndrome) that appeared to be based on allergic-type reactions, which may rarely be fatal. These have included 1 or more of the following: a severe generalized reaction that may include shortness of breath, wheezing, digestive symptoms, and low blood pressure and even shock; an allergic reaction with swelling of the face, lips, tongue, and/or throat with difficulty swallowing or breathing; symptoms mimicking lupus (a disorder in which a person's immune system may attack parts of his or her own body); severe muscle and blood vessel inflammation, sometimes including rash; bruises; various disorders of blood cells (that could result in anemia, infection, or blood clotting problems) or abnormal blood tests; inflamed or painful joints; hives; fatigue and weakness; sensitivity to sunlight; fever, chills; flushing; difficulty breathing; and severe skin disorders that vary from rash to a serious burn-like shedding of skin all over the body, including mucous membranes such as the lining of the mouth.

Other: Loss of sexual desire, breast enlargement, impotence.

Laboratory Tests: Liver function test abnormalities including elevated alkaline phosphatase and bilirubin; thyroid function abnormalities.

NOTE: This summary provides important information about ZOCOR. If you would like more information, ask your doctor or pharmacist to let you read the prescribing information and then discuss it with them.



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FORUM

the enslavement of Africans, the poor treatment of African Americans, and our continuing marginalization of people based on income, gender, and sexual orientation.

JOANNE M. DAVIS
Dallas, Texas

Baghdad Before the Bombs

I didn't see any pictures of the mass graves filled with Saddam Hussein's victims. I didn't see any pictures of the people his son Uday dropped alive into a shredder, the government official whose teeth had been removed with pliers, or the family of the woman chopped up for talking to CNN. I guess that depicting the Iraq of Saddam Hussein was not something you or your reporter wanted to bother with.

DAN COTTO-THORNER
Naperville, Illinois

Paving Peru

The idea that the construction of a paved highway through this part of the world would be an irrevocable loss is largely a product of people who have spent their lives driving on asphalt. It is easy for someone to lament the loss of a pristine ecosystem or corruption of an innocent culture after having viewed it on cable television. Traveling through the Andes on the roof of a cargo truck may seem rustic, but I'm sure it gets old when you live it and don't have a plane ticket home stashed in your backpack.

REX A. JACKMAN
Arcata, California

I just finished the article, and I'm aghast at the last sentence: "These people, I thought, need a better road." This is tantamount to saying that NATIONAL GEOGRAPHIC believes in illegal harvesting of mahogany, more cars, burning of fossil fuels, indescribable pollution, and habitat destruction. And how about 7-Elevens bordering the rain forest as well? And the heck with the indigenous cultures too.

BOB FEIT
Chesapeake, Virginia
FROM OUR ONLINE FORUM
nationalgeographic.com/ngm/0306

I grew up in Bolivia on the Beni River. When I was a child, my missionary father told me to relish and never forget what I was seeing,

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because it would never be the same. While I ache for the world of memories that your article stirred, I know the people of Peru yearn for the advances that the road can bring. I also know all too well the discomfort and danger of living in remote jungle settlements. I support neither the voracious appetite of irresponsible industry nor the silly environmentalists who believe any alarmist's tale.

STEVE OTTAVIANO
Waxhaw, North Carolina

Siberian Gold

If I were to take shovel in hand and invade the pioneer cemetery in my community, even for strictly scientific purposes, I would probably face arrest for grave robbing. Just how are archaeologists who root around in ancient burial grounds and cart off the contents any different? Is it just that the ancients no longer have someone around to protect their remains? I for one could do without seeing their bones in a glass museum case. Let them rest.

MICHAEL ABEL
Midvale, Utah

ZipUSA: Oak Bluffs, Massachusetts

What was the point of zip 02557? The article barely touched on the history behind the community. It held no substance other than to scream that Oak Bluffs is a place for rich, successful black Americans to hobnob with their own kind.

GEORGE C. NEMO
Hampton, Virginia

Flashback

The photo of Faisal I was credited to Ernest B. Schoedsack. Readers might recognize his name from movie credits. After starting out as a feature-film cameraman, Schoedsack became a documentary filmmaker and then a director of action films, from *The Most Dangerous Game* to *Dr. Cyclops*. His crowning achievement, *King Kong*, holds up very well today.

MICHAEL REESE MUCH
Bethlehem, Pennsylvania

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HEALTH

Polio's Last Mile

India fights back after largest outbreak in recent history

Polio was meant to be gone. By 2002. That's what health officials hoped would be the result of the Global Polio Eradication Initiative, launched in 1988.

Although aggressive vaccination programs to protect children have cut an annual 350,000 polio cases worldwide to fewer than 2,000 in seven countries, the disease has

made a comeback, mainly in Nigeria, Pakistan, and India. Cases in India rose from 268 in 2001 to 1,600 in 2002.

How did this disease—that by invading the spinal cord and brain can cause muscle weakness and atrophy or, in severe cases, permanent paralysis or death—return to India with such a vengeance after near eradication?

A majority of India's victims live in Uttar Pradesh, the country's most populous state and one of its poorest. People are crowded together, with open sewers the norm. Such conditions favor transmission of the poliovirus, which lives and replicates in the intestines and spreads either from person to person or by ingestion of

APHICA



C R E A T U R E S O F O U R U N I V E R S E

A boy in Moradabad gets a few drops of polio vaccine. Multiple national campaigns in 2003 have each targeted 165 million children as part of India's push to eradicate the paralyzing disease by 2005.

KAREN KASMAUSKI

anything that is contaminated with infected fecal material.

Another contributing factor: Nearly two-thirds of polio sufferers in Uttar Pradesh are Muslims. The fact that male health care workers cannot enter Muslim homes has complicated immunization efforts by the Indian government and other organizations helping in the fight to eradicate the disease: the World Health Organization (WHO), the U.S. Centers for Disease Control and Prevention (CDC), UNICEF, and Rotary International. "Muslim women aren't supposed to let male strangers into their homes," says Monique Petrofsky, a CDC nurse epidemiologist who accompanied an immunization team.

Repeated visits from health care workers also raise suspicions in Muslim communities distrustful of the Hindu-led government's motives. "All of a sudden workers show up with these drops, and people wonder: Is this birth control? Will this



INDIAN CHILD DISABLED BY POLIO.



BUSY STREET IN INDIA'S UTTAR PRADESH.

KAREN KASMAUSKI (BOTH)

make my child sterile?" says Bruce Aylward, WHO's coordinator for the Global Polio Eradication Initiative. Many parents refuse multiple vaccinations for their children, unaware that at least four doses are needed.

Still another cause of the upswing may have been overconfidence. With cases declining sharply, the Indian government in 2001 reduced mass immunizations everywhere, including in high-risk zones. In hindsight it was a tragic error.

But now the government has changed tactics, targeting the needs of the poor, including the country's Muslim minority. Trusted local schoolteachers, academics, doctors, and imams have joined immunization teams. Mosques announce vaccination days on the same loudspeakers used to call worshipers to prayer. And a woman is now included on nearly every team.

The hope is to eradicate polio from India—and from the Earth—by 2005. "We know villages and even specific blocks where children are not immunized," says a spokesman for the National Polio Surveillance Project in New Delhi. "We are closing in on this virus once and for all." —*Bijal P. Trivedi*

Other Diseases We Can Eradicate

Only one human disease has ever been officially declared eradicated by world authorities: smallpox, in 1980. After polio, here are four that could fall.

Guinea worm The only other disease with a formal global eradication plan (estimated date: five years after war in Sudan ends). Affects 55,000 people in 13 African nations; 75 percent of cases are in southern Sudan. Eruption of worm from body causes debilitating pain.

Measles Kills some 800,000 children under the age of five annually in the developing world.

Rubella An estimated 100,000 babies are born blind, deaf, or mentally impaired each year as a result of maternal infection with rubella in early pregnancy.

Hepatitis B Believed to contribute to over 600,000 deaths annually. A challenging foe because many carriers are symptomless, yet still can spread the disease.

WEBSITE EXCLUSIVE

Find links with more information about polio and other diseases at nationalgeographic.com/ngm/resources/0310.

"I'VE NEVER SEEN ANYTHING LIKE IT."

- GUY WHO'S SEEN EVERYTHING

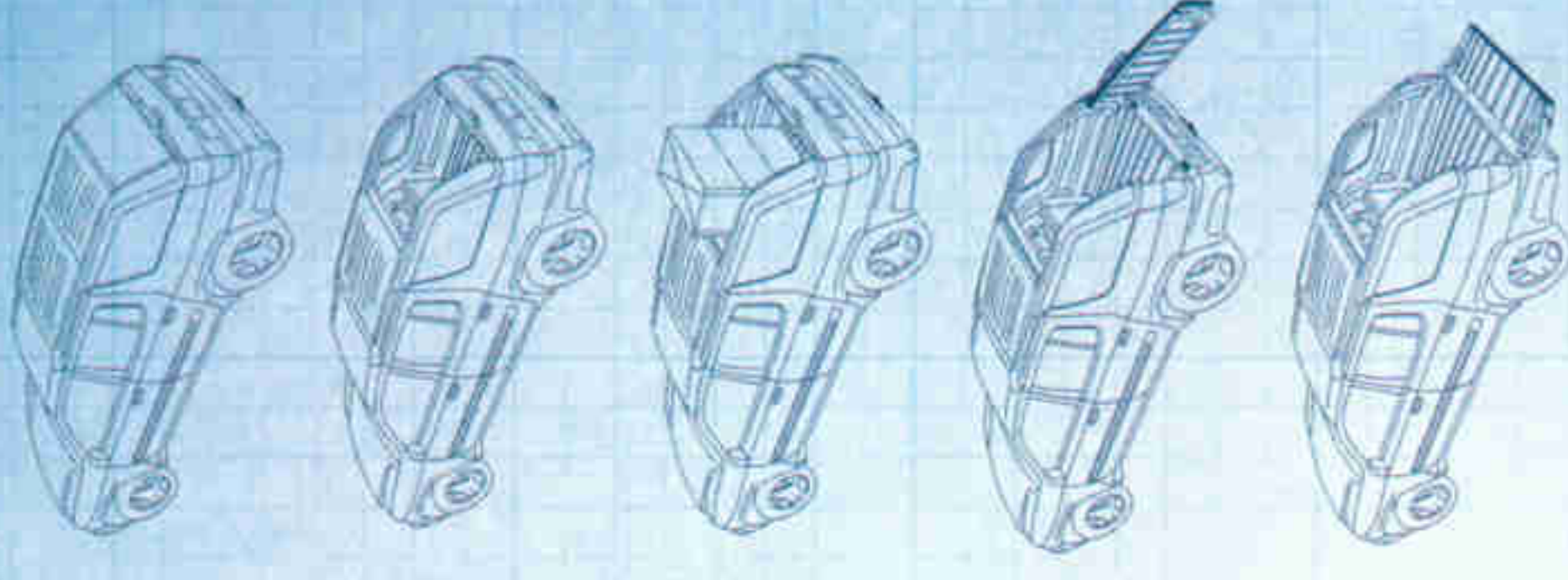


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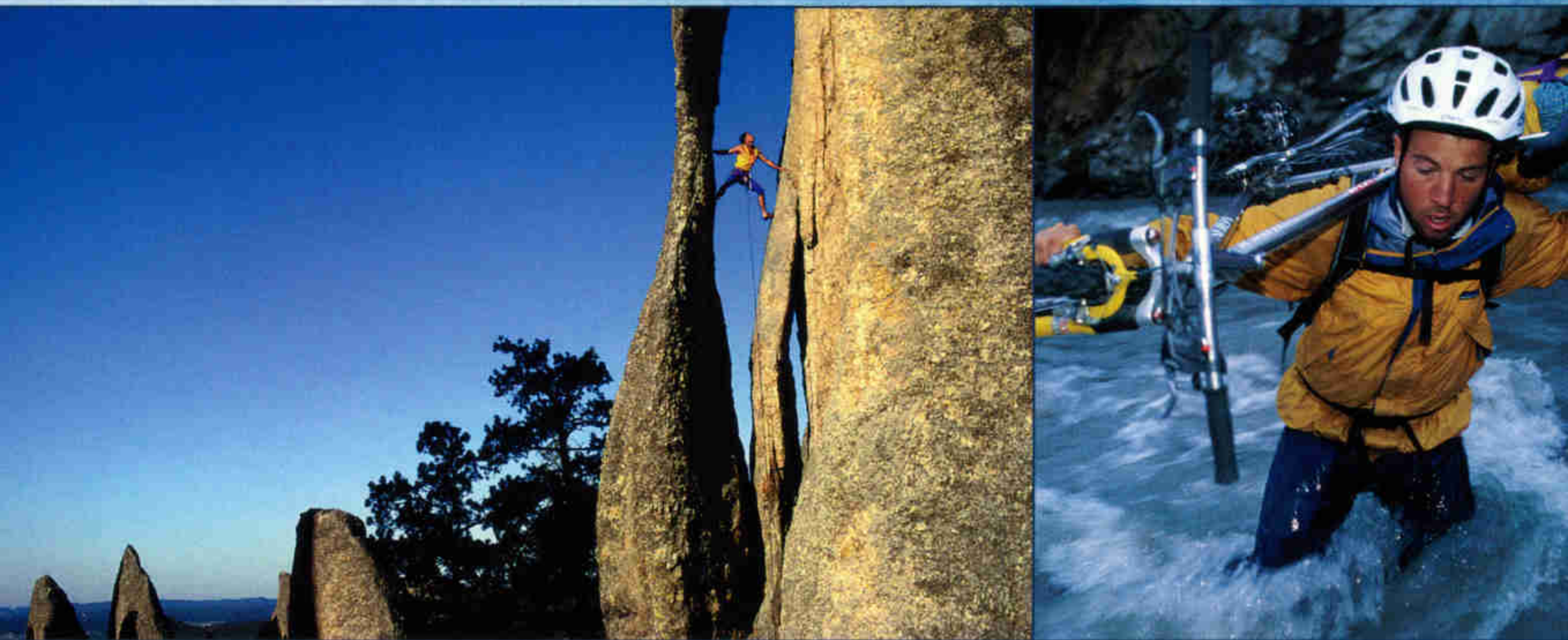
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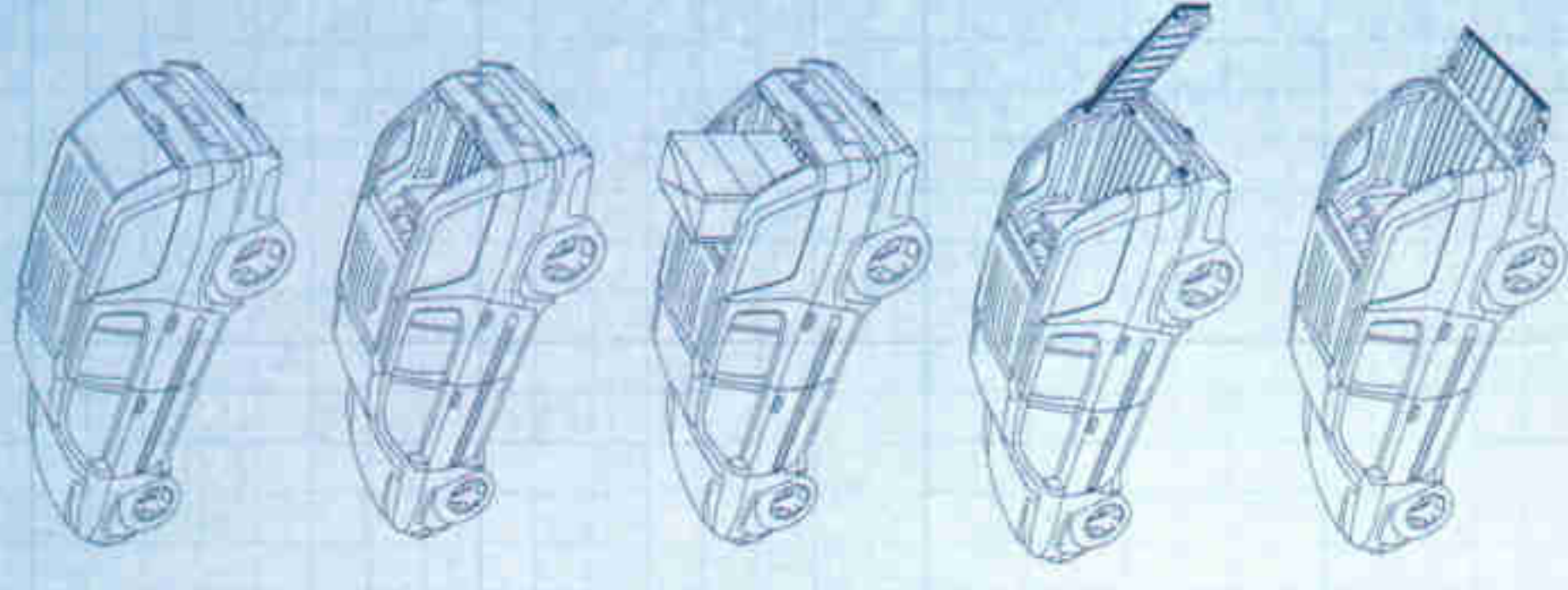


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CHRISTOPHER WOODS

ARCHITECTURE

London's Other Underground

Below the city, a massive reservoir bares its bones

Inside it looks like a cathedral—but it's under a golf course and usually contains over 65 million gallons of water. Workers in London recently drained Honor Oak, one of Europe's largest underground reservoirs, for repairs, exposing the 94-year-old Edwardian structure's brickwork, archways, and buttresses (above). Honor Oak opened in 1909 after three years of construction. The multi-section reservoir normally holds more water than 70 Olympic-size swimming pools.

It was emptied one section at a time to keep up service to south-east London. —Laura Lewis

More Buried Treasures

London's Mail Rail A 6.5-mile subterranean railway delivered mail across town from 1927 to May 2003.

WWII air-raid shelters Eight deep shelters that could each sleep and feed 8,000 people were built after the Blitz. Today's use: archives and a phone exchange.



JÖRG ADAM

MARINE BIOLOGY

Found: Tiniest Horse in the Sea

Just six-tenths of an inch long, *Hippocampus denise*, the smallest seahorse species yet discovered, was found on an Indonesian reef. Sara Lourie of McGill University and Project Seahorse searched for the pygmy seahorse after seeing a picture taken by nature photographer Denise Tackett. Says Sara, "We examined every little branch of coral for the telltale sign of an eye or a curled tail." —John L. Eliot

LAST CALL

Monster Catfish of the Mekong

This fish story is true. But the catch in question, the Mekong giant catfish, is fast disappearing. Up to ten feet long and weighing in at as much as 650 pounds, it ranks among the world's largest freshwater fish. Once abundant along a 500-mile stretch of the Mekong River that winds through Myanmar (Burma), Thailand, Laos, and Cambodia, the behemoths are now vanishing, probably due to overfishing. In Thailand none have been caught for two years. But in Cambodia a few are still netted, and it's there that biologist Zeb Hogan heads the Mekong Fish Conservation Project, supported by the National Geographic Society's Conservation Trust. Zeb pays local fishermen for their catch, hoping to find some catfish still alive (the one below had died). He tags live fish, then releases them. Among the information on the tag is his phone number, and fishermen netting tagged fish are urged to call. "We're trying to understand how the fish migrate and to do genetic studies on them," he says. "We also want to educate people about the importance of conserving them." —J.L.E.



ZEB HOGAN

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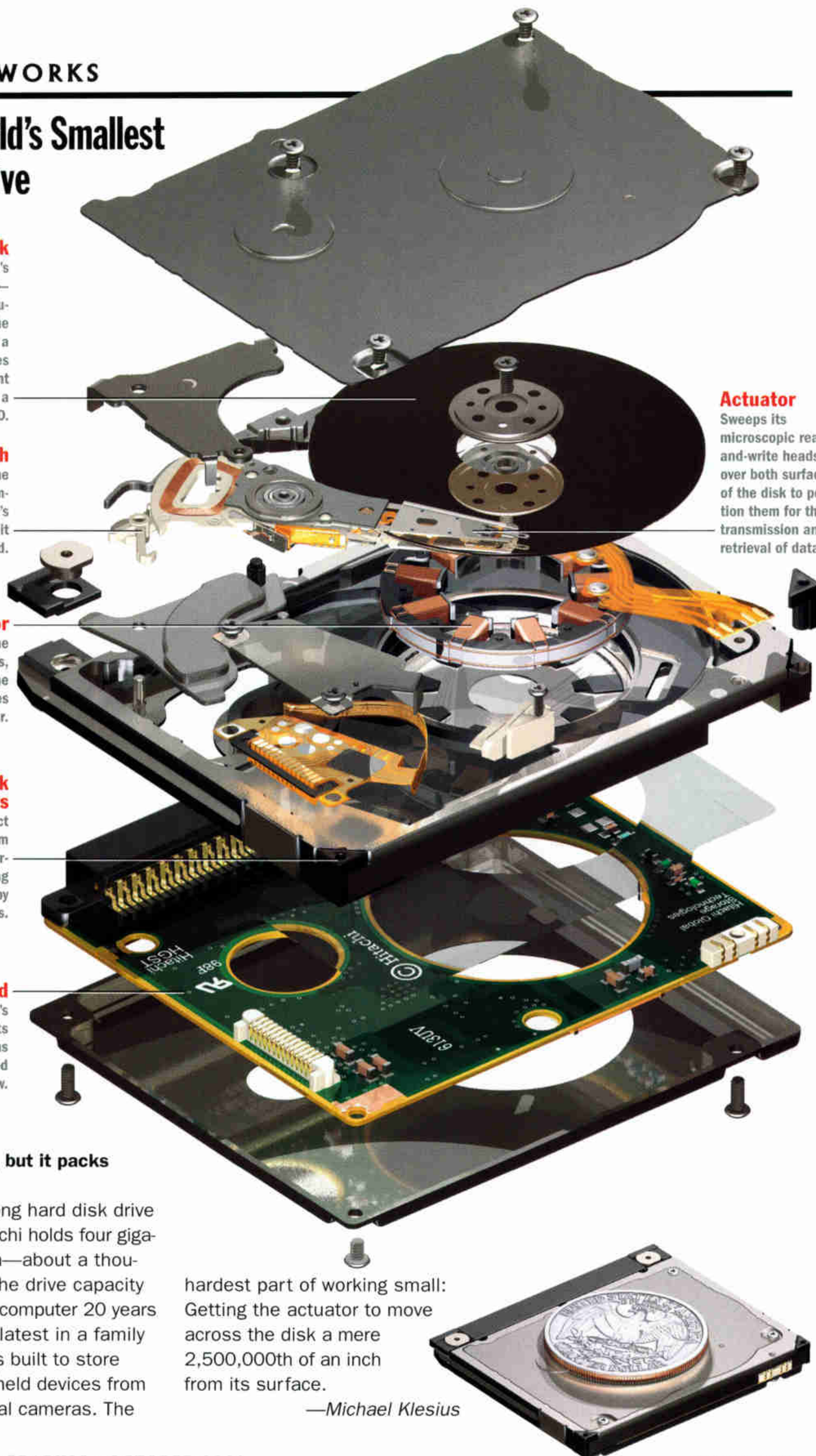
Sweeps its microscopic read-and-write heads over both surfaces of the disk to position them for the transmission and retrieval of data.

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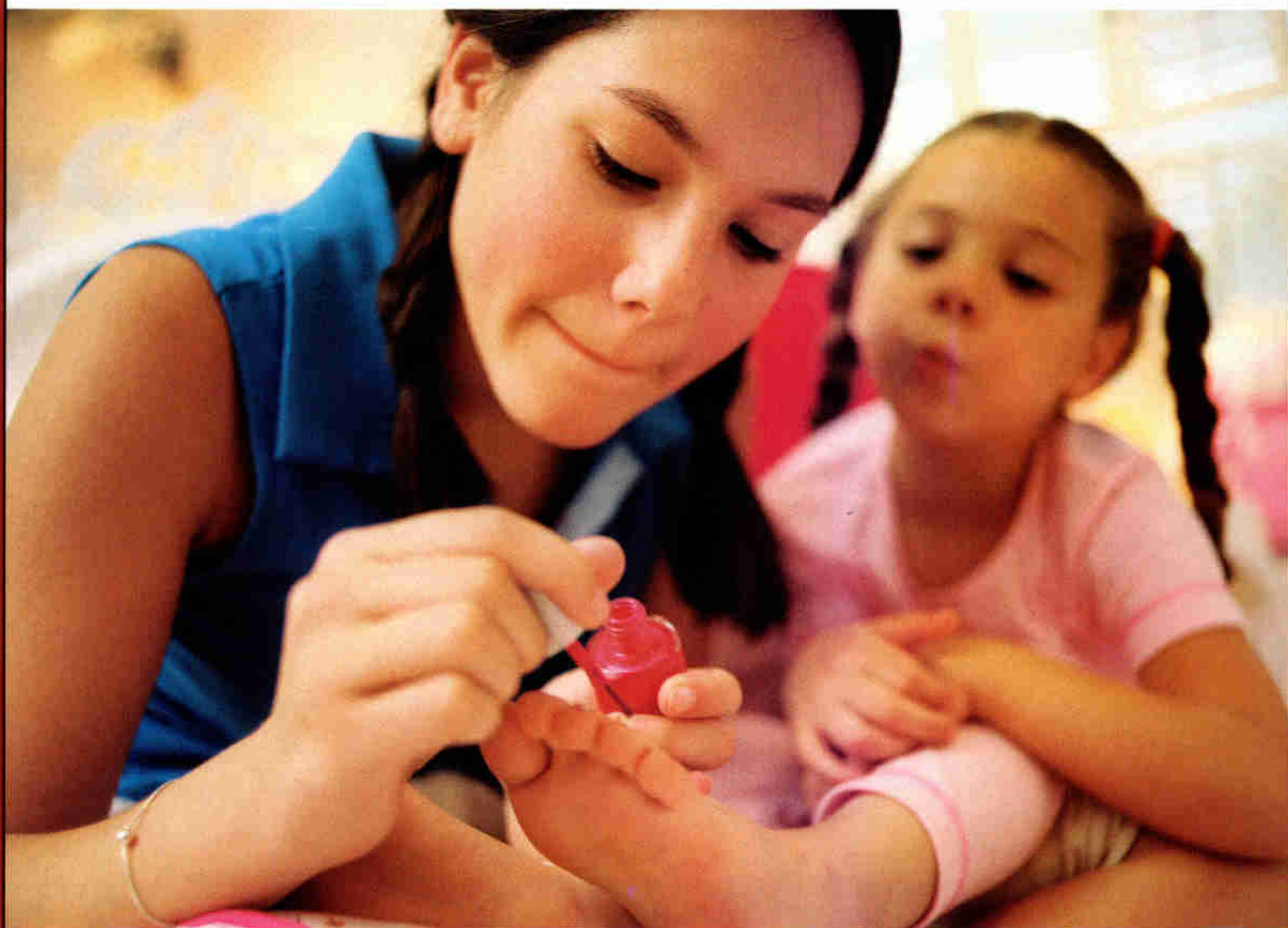
A new inch-long hard disk drive made by Hitachi holds four gigabytes of data—about a thousand times the drive capacity of a desktop computer 20 years ago. It's the latest in a family of hard drives built to store data in handheld devices from PDAs to digital cameras. The

hardest part of working small: Getting the actuator to move across the disk a mere 2,500,000th of an inch from its surface.

—Michael Klesius



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BIOLOGY

It's All in the Genes

A DNA bar code can help scientists ID species

Imagine working as an agricultural inspector at an airport and finding an insect in a passenger's fruit basket: Is it a foreign species that could damage crops? Problem is, depending on the bug, there might be only a handful of experts who could ID it—and you might have to mail the specimen to one of them.

Evolutionary biologist Paul Hebert of Canada's University of Guelph has proposed a system for using DNA to identify animals. Hebert wants to develop an electronic catalog of what he calls bar codes for all animal species, each code represented by a string of 645 A's, C's, G's, and T's—shorthand for the chemical subunits, or bases, that make up



DNA. This 645-letter string is found in a specific gene that is common to all animals, yet the string varies from species to species.

If Hebert's idea is put into use, anybody with relatively cheap and portable DNA analysis equipment could identify almost any animal. Eventually, a new species could first be known

by its bar code. The Latin name could come later.

In a recent blind test of the system, Hebert received legs from 200 moth species. By grinding up each leg to obtain a DNA sample and analyze its bar code, he and his colleagues were able to ID each species—something a moth specialist would be hard-pressed to do even with the luxury of whole animals to examine. (Many insects are identified by dissecting their abdomens to examine their sex organs.)

Bar coding would help biologists with another challenge: identifying a species with a complex life cycle when there is only an egg or a larva to work with. Many invertebrates, which account for more than 95 percent of all animal species, are only identifiable in their adult forms. Bar coding solves that because DNA's pattern is constant from day one to death.

—Hillel J. Hoffmann

MARKETPLACE

Gold That Swims

The northern bluefin tuna (*Thunnus thynnus*) may be the most financially valuable wild animal on Earth.

Value of one adult northern bluefin tuna: Often over \$10,000, although one prime specimen is reported to have sold for \$173,000.

Weight of one adult northern bluefin tuna: Typically 250 to 300 pounds (world record is 1,496). Size of large tunas has decreased due to overfishing.

How bluefins are bought:

Brokers usually buy tunas on New England docks directly from fishermen. The fish are immediately frozen, then shipped by air to Japan for auction in wholesale seafood



JAMES L. STANFIELD

markets like Tokyo's giant Tsukiji market (above), the center of the tuna trade.

Price of one order (two thin slices) of bluefin sushi in a Tokyo restaurant: Around \$100.

Why is October 10 Tuna Day in Japan?

Because the Japan Tuna cooperative says so. The date coincides with the writing of a poem about tuna published in an eighth-century work named *Manyōshū*.



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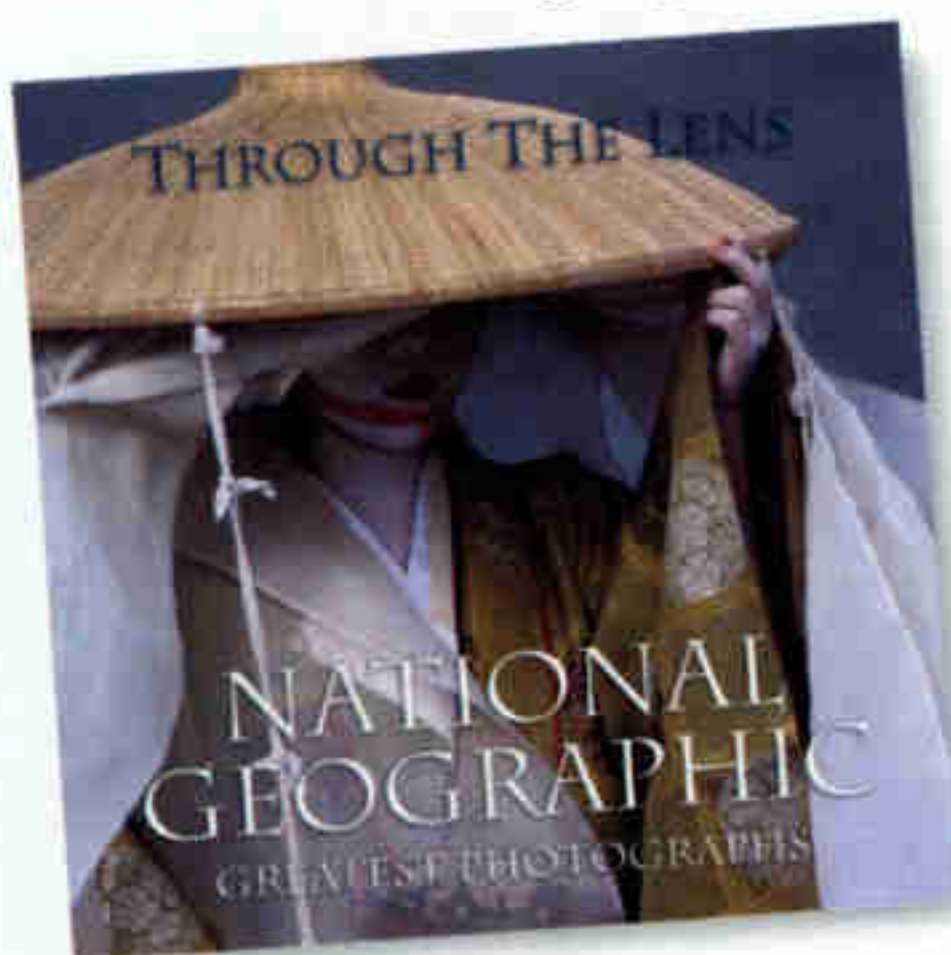
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SAM ABELL

Looking Through the Lens

National Geographic's largest photography book ever



Castration and branding may not be rituals familiar to all, but cowboys instantly recognize the scene above. "It's authentic to the rhythm of their lives," says photographer Sam Abell of the Montana image, one of 250 in *Through the Lens: National Geographic's Greatest Photographs*. The collection offers glimpses of

the kinds of moments that can only be captured "when photographers are in the field for a long time," says the book's editor, Leah Bendavid-Val. At 504 pages, it's the largest compilation of photos ever assembled by the Society. The book will be published in 20 languages and sells for \$30; find it online at shopng.com or wherever books are sold. A complementary exhibit will run through November 2 at the Society's headquarters in Washington, D.C.

NEW NG CHANNEL SERIES

Animal Immersion

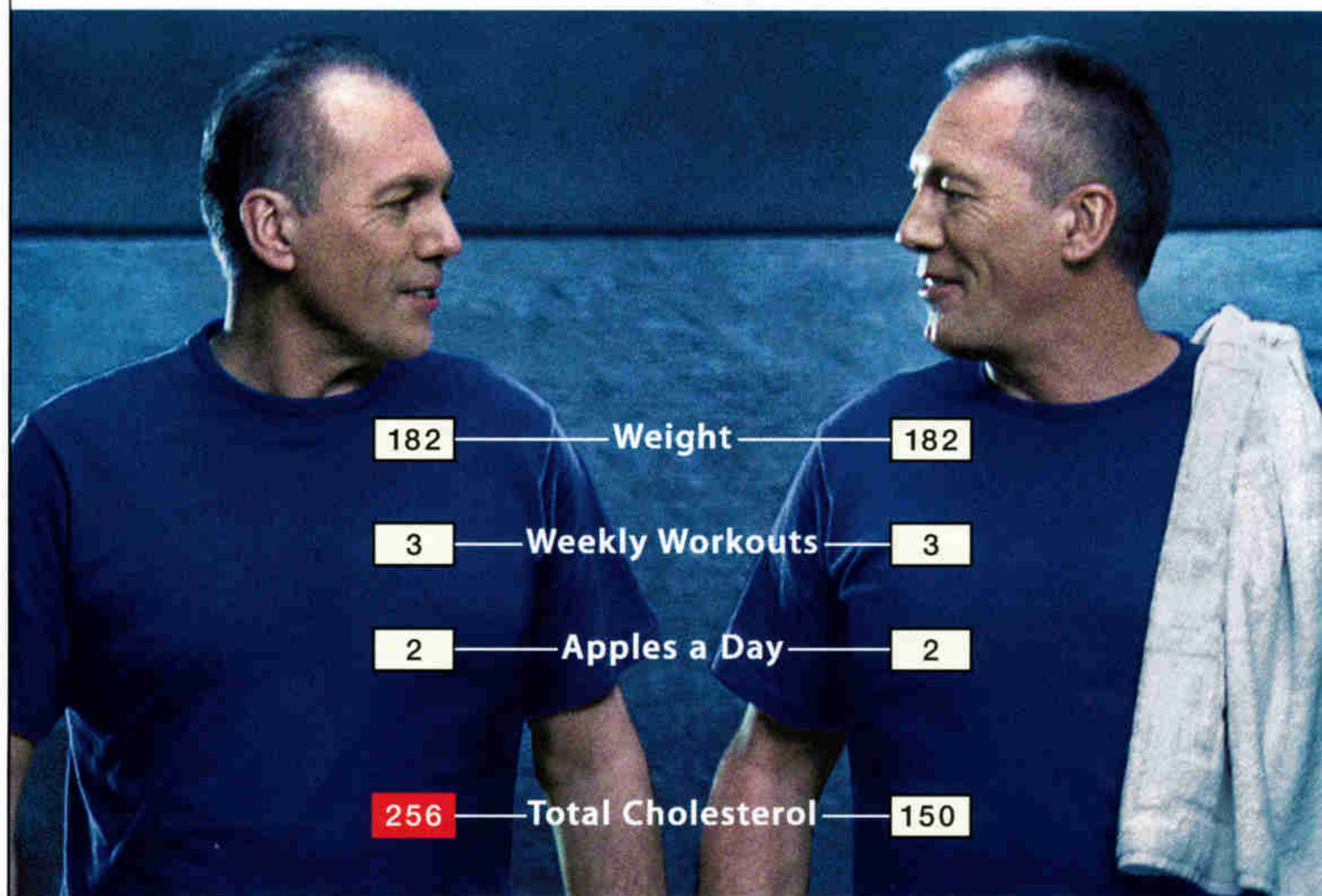
Simply watching animals' behavior isn't enough for veteran filmmakers Chris, left, and Martin Kratt. The brothers try to get inside the minds of animals in

their new series on the National Geographic Channel (Sundays at 8 p.m. ET/PT), *Be the Creature*. The Kratts hang with lemurs, run with wild dogs, even eat like bears—all to show what makes critters tick. The series debuts October 5.



MONICA MCKENNA

Two of a kind. Until one took Lipitor.



Important information:

LIPITOR® (atorvastatin calcium) is a prescription drug used with diet to lower cholesterol. LIPITOR is not for everyone, including those with liver disease or possible liver problems, women who are nursing, pregnant, or may become pregnant. LIPITOR has not been shown to prevent heart disease or heart attacks.

If you take LIPITOR, tell your doctor about any unusual muscle pain or weakness. This could be a sign of serious side effects. It is important to tell your doctor about any medications you are currently taking to avoid possible serious drug interactions. Your doctor may do simple blood tests to monitor liver function before and during drug treatment. The most commonly reported side effects are gas, constipation, stomach pain and indigestion. They are usually mild and tend to go away.

Please see additional important information on next page.

Here's something that might make you think twice. Even if you do the right things, you can still have high cholesterol. In fact, for 2 out of 3 adults with high cholesterol, diet and exercise may not lower it enough. The good news is that LIPITOR can lower your total cholesterol 29% to 45%*. It can lower your bad cholesterol 39% to 60%*. (*The average effect depends on the dose.) So talk to your doctor today to find out if LIPITOR is right for you. To learn more, call us at 1-888-LIPITOR or find us on the web at www.lipitor.com.



FOR CHOLESTEROL®

LIPITOR® (Atorvastatin Calcium) Tablets
Brief Summary of Prescribing Information

CONTRAINDICATIONS: Active liver disease or unexplained persistent elevations of serum transaminases. Hypersensitivity to any component of this medication. **Pregnancy and Lactation** — Atherosclerosis is a chronic process and discontinuation of lipid-lowering drugs during pregnancy should have little impact on the outcome of long-term therapy of primary hypercholesterolemia. Cholesterol and other products of cholesterol biosynthesis are essential components for fetal development (including synthesis of steroids and cell membranes). Since HMG-CoA reductase inhibitors decrease cholesterol synthesis and possibly the synthesis of other biologically active substances derived from cholesterol, they may cause fetal harm when administered to pregnant women. Therefore, HMG-CoA reductase inhibitors are contraindicated during pregnancy and in nursing mothers. ATORVASTATIN SHOULD BE ADMINISTERED TO WOMEN OF CHILD-BEARING AGE ONLY WHEN SUCH PATIENTS ARE HIGHLY UNLIKELY TO CONCEIVE AND HAVE BEEN INFORMED OF THE POTENTIAL HAZARDS. If the patient becomes pregnant while taking this drug, therapy should be discontinued and the patient apprised of the potential hazard to the fetus.

WARNINGS: Liver Dysfunction — HMG-CoA reductase inhibitors, like some other lipid-lowering therapies, have been associated with biochemical abnormalities of liver function. **Persistent elevations (>3 times the upper limit of normal [ULN] occurring on 2 or more occasions) in serum transaminases occurred in 0.7% of patients who received atorvastatin in clinical trials. The incidence of these abnormalities was 0.2%, 0.2%, 0.6%, and 2.3% for 10, 20, 40, and 80 mg, respectively.** One patient in clinical trials developed jaundice. Increases in liver function tests (LFT) in other patients were not associated with jaundice or other clinical signs or symptoms. Upon dose reduction, drug interruption, or discontinuation, transaminase levels returned to or near pretreatment levels without sequelae. Eighteen of 30 patients with persistent LFT elevations continued treatment with a reduced dose of atorvastatin. **It is recommended that liver function tests be performed prior to and at 12 weeks following both the initiation of therapy and any elevation of dose, and periodically (eg, semiannually) thereafter.** Liver enzyme changes generally occur in the first 3 months of treatment with atorvastatin. Patients who develop increased transaminase levels should be monitored until the abnormalities resolve. Should an increase in ALT or AST of >3 times ULN persist, reduction of dose or withdrawal of atorvastatin is recommended. Atorvastatin should be used with caution in patients who consume substantial quantities of alcohol and/or have a history of liver disease. Active liver disease or unexplained persistent transaminase elevations are contraindications to the use of atorvastatin (see CONTRAINDICATIONS).

Skeletal Muscle — **Rare cases of rhabdomyolysis with acute renal failure secondary to myoglobinuria have been reported with atorvastatin and with other drugs in this class.** Uncomplicated myalgia has been reported in atorvastatin-treated patients (see ADVERSE REACTIONS). Myopathy, defined as muscle aches or muscle weakness in conjunction with increases in creatine phosphokinase (CPK) values >10 times ULN, should be considered in any patient with diffuse myalgias, muscle tenderness or weakness, and/or marked elevation of CPK. Patients should be advised to report promptly unexplained muscle pain, tenderness or weakness, particularly if accompanied by malaise or fever. Atorvastatin therapy should be discontinued if markedly elevated CPK levels occur or myopathy is diagnosed or suspected. The risk of myopathy during treatment with drugs in this class is increased with concurrent administration of cyclosporine, fibric acid derivatives, erythromycin, niacin, or azole antifungals. Physicians considering combined therapy with atorvastatin and fibric acid derivatives, erythromycin, immunosuppressive drugs, azole antifungals, or lipid-lowering doses of niacin should carefully weigh the potential benefits and risks and should carefully monitor patients for any signs or symptoms of muscle pain, tenderness, or weakness, particularly during the initial months of therapy and during any periods of upward dosage titration of either drug. Periodic creatine phosphokinase (CPK) determinations may be considered in such situations, but there is no assurance that such monitoring will prevent the occurrence of severe myopathy. **Atorvastatin therapy should be temporarily withheld or discontinued in any patient with an acute, serious condition suggestive of a myopathy or having a risk factor predisposing to the development of renal failure secondary to rhabdomyolysis (eg, severe acute infection, hypotension, major surgery, trauma, severe metabolic, endocrine and electrolyte disorders, and uncontrolled seizures).**

PRECAUTIONS: General — Before instituting therapy with atorvastatin, an attempt should be made to control hypercholesterolemia with appropriate diet, exercise, and weight reduction in obese patients, and to treat other underlying medical problems (see INDICATIONS AND USAGE in full prescribing information).

Information for Patients — Patients should be advised to report promptly unexplained muscle pain, tenderness, or weakness, particularly if accompanied by malaise or fever. **Drug Interactions** — The risk of myopathy during treatment with drugs of this class is increased with concurrent administration of cyclosporine, fibric acid derivatives, niacin (nicotinic acid), erythromycin, azole antifungals (see WARNINGS, Skeletal Muscle).

Antacid: When atorvastatin and Maalox® TC suspension were coadministered, plasma concentrations of atorvastatin decreased approximately 35%. However, LDL-C reduction was not altered. **Antipyryne:** Because atorvastatin does not affect the pharmacokinetics of antipyryne, interactions with other drugs metabolized via the same cytochrome isozymes are not expected. **Colestipol:** Plasma concentrations of atorvastatin decreased approximately 25% when colestipol and atorvastatin were coadministered. However, LDL-C reduction was greater when atorvastatin and colestipol were coadministered than when either drug was given alone.

Cimetidine: Atorvastatin plasma concentrations and LDL-C reduction were not altered by coadministration of cimetidine. **Digoxin:** When multiple doses of atorvastatin and digoxin were coadministered, steady-state plasma digoxin concentrations increased by approximately 20%. Patients taking digoxin should be monitored appropriately. **Erythromycin:** In healthy individuals, plasma concentrations of atorvastatin increased approximately 40% with coadministration of atorvastatin and erythromycin, a known inhibitor of cytochrome P450 3A4 (see WARNINGS, Skeletal Muscle). **Oral Contraceptives:** Coadministration of atorvastatin and an oral contraceptive increased AUC values for norethindrone and ethinyl estradiol by approximately 30% and 20%. These increases should be considered when selecting an oral contraceptive for a woman taking atorvastatin.

Warfarin: Atorvastatin had no clinically significant effect on prothrombin time when administered to patients receiving chronic warfarin treatment. **Endocrine Function** — HMG-CoA reductase inhibitors interfere with cholesterol synthesis and theoretically might blunt adrenal and/or gonadal steroid production. Clinical studies have shown that atorvastatin does not reduce basal plasma cortisol concentration or impair adrenal reserve. The effects of HMG-CoA reductase inhibitors on male fertility have not been studied in adequate numbers of patients. The effects, if any, on the pituitary-gonadal axis in premenopausal women are unknown. Caution should be exercised if an HMG-CoA reductase inhibitor is administered concomitantly with drugs that may decrease the levels or activity of endogenous steroid hormones, such as ketoconazole, spironolactone, and cimetidine. **CNS Toxicity** — Brain hemorrhage was seen in a female dog treated for 3 months at 120 mg/kg/day. Brain hemorrhage and optic nerve vacuolation were seen in another female dog that was sacrificed in moribund condition after 11 weeks of escalating doses up to 280 mg/kg/day. The 120 mg/kg dose resulted in a systemic exposure approximately 16 times the human plasma area-under-the-curve (AUC, 0-24 hours) based on the maximum human dose of 80 mg/day. A single tonic convulsion was seen in each of 2 male dogs (one treated at 10 mg/kg/day and one at 120 mg/kg/day) in a 2-year study. No CNS lesions have been observed in mice after chronic treatment for up to 2 years at doses up to 400 mg/kg/day or in rats at doses up to 100 mg/kg/day. These doses were 6 to 11 times (mouse) and 8 to 16 times (rat) the human AUC (0-24) based on the maximum recommended human dose of 80 mg/day. CNS vascular lesions, characterized by perivascular hemorrhages, edema, and mononuclear cell infiltration of perivascular spaces, have been observed in dogs treated with other members of this class. A chemically similar drug in this class produced optic nerve degeneration (Wallerian degeneration of retinogeniculate fibers) in clinically normal dogs in a dose-dependent fashion at a dose that produced plasma drug levels about 30 times higher than the mean drug level in humans taking the highest recommended dose. **Carcinogenesis, Mutagenesis, Impairment of Fertility** — In a 2-year carcinogenicity study in rats at dose levels of 10, 30, and 100 mg/kg/day, 2 rare tumors were found in muscle in high-dose females: in one, there was a rhabdomyosarcoma and, in another, there was a fibrosarcoma. This dose represents a plasma AUC (0-24) value of approximately 16 times the mean human plasma drug exposure after an 80 mg oral dose. A 2-year carcinogenicity study in mice given 100, 200, or 400 mg/kg/day resulted in a significant increase in liver adenomas in high-dose males and liver carcinomas in high-dose females. These findings occurred at plasma AUC (0-24) values of approximately 6 times the mean human plasma drug exposure after an 80 mg oral dose. *In vitro*, atorvastatin was not mutagenic or clastogenic in the following tests with and without metabolic activation: the Ames test with *Salmonella typhimurium* and *Escherichia coli*, the HGPRT forward mutation assay in Chinese hamster lung cells, and the chromosomal aberration assay in Chinese hamster lung cells. Atorvastatin was negative in the *in vivo* mouse micronucleus test. Studies in rats performed at doses up to 175 mg/kg (15 times the human exposure) produced no changes in fertility. There was aplasia and aspermia in the epididymis of 2 of 10 rats treated with 100 mg/kg/day of atorvastatin for 3 months (16 times the human AUC at the 80 mg dose); testis weights were significantly lower at 30 and 100 mg/kg and epididymal weight was lower at 100 mg/kg. Male rats given 100 mg/kg/day for 11 weeks prior to mating had decreased sperm motility, spermatid head concentration, and increased abnormal sperm. Atorvastatin caused no adverse effects on semen parameters, or reproductive organ histopathology in dogs given doses of 10, 40, or 120 mg/kg for two years. **Pregnancy** —

Pregnancy Category X: See CONTRAINDICATIONS. Safety in pregnant women has not been established. Atorvastatin crosses the rat placenta and reaches a level in fetal liver equivalent to that of maternal plasma. Atorvastatin was not teratogenic in rats at doses up to 300 mg/kg/day or in rabbits at doses up to 100 mg/kg/day. These doses resulted in multiples of about 30 times (rat) or 20 times (rabbit) the human exposure based on surface area (mg/m²). In a study in rats given 20, 100, or 225 mg/kg/day, from gestation day 7 through to lactation day 21 (weaning), there was decreased pup survival at birth, neonate, weaning, and maturity in pups of mothers dosed with 225 mg/kg/day. Body weight was decreased on days 4 and 21 in pups of mothers dosed at 100 mg/kg/day; pup body weight was decreased at birth and at days 4, 21, and 91 at 225 mg/kg/day. Pup development was delayed (rotorod performance at 100 mg/kg/day and acoustic startle at 225 mg/kg/day; pinnae detachment and eye opening at 225 mg/kg/day). These doses correspond to 6 times (100 mg/kg) and 22 times (225 mg/kg) the human AUC at 80 mg/day. Rare reports of congenital anomalies have been received following intrauterine exposure to HMG-CoA reductase inhibitors. There has been one report of severe congenital bony deformity, tracheo-esophageal fistula, and anal atresia (VATER association) in a baby born to a woman who took lovastatin with dextroamphetamine sulfate during the first trimester of pregnancy. LIPITOR

should be administered to women of child-bearing potential only when such patients are highly unlikely to conceive and have been informed of the potential hazards. If the woman becomes pregnant while taking LIPITOR, it should be discontinued and the patient advised again as to the potential hazards to the fetus.

Nursing Mothers — Nursing rat pups had plasma and liver drug levels of 50% and 40%, respectively, of that in their mother's milk. Because of the potential for adverse reactions in nursing infants, women taking LIPITOR should not breast-feed (see CONTRAINDICATIONS). **Pediatric Use** — Safety and effectiveness in patients 10-17 years of age with heterozygous familial hypercholesterolemia have been evaluated in controlled clinical trials of 6 months duration in adolescent boys and postmenarchal girls. Patients treated with LIPITOR had an adverse experience profile generally similar to that of patients treated with placebo, the most common adverse experiences observed in both groups, regardless of causality assessment, were infections. **Doses greater than 20 mg have not been studied in this patient population.** In this limited controlled study, there was no detectable effect on growth or sexual maturation in boys or on menstrual cycle length in girls. See CLINICAL PHARMACOLOGY, *Clinical Studies* section in full prescribing information; ADVERSE REACTIONS, *Pediatric Patients*, and DOSAGE AND ADMINISTRATION, *Pediatric patients (10-17 years of age) with Heterozygous Familial Hypercholesterolemia* in full prescribing information. Adolescent females should be counseled on appropriate contraceptive methods while on LIPITOR therapy (see CONTRAINDICATIONS and PRECAUTIONS, *Pregnancy*). **LIPITOR has not been studied in controlled clinical trials involving pre-pubertal patients or patients younger than 10 years of age.** Clinical efficacy with doses up to 80 mg/day for 1 year have been evaluated in an uncontrolled study of patients with homozygous FH including 8 pediatric patients. See CLINICAL PHARMACOLOGY, *Clinical Studies in Homozygous Familial Hypercholesterolemia* in full prescribing information. **Geriatric Use** — The safety and efficacy of atorvastatin (10-80 mg) in the geriatric population (≥65 years of age) was evaluated in the ACCESS study. In this 54-week open-label trial 1,958 patients initiated therapy with atorvastatin 10 mg. Of these, 835 were elderly (≥65 years) and 1,123 were non-elderly. The mean change in LDL-C from baseline after 6 weeks of treatment with atorvastatin 10 mg was -38.2% in the elderly patients versus -34.6% in the non-elderly group. The rates of discontinuation due to adverse events were similar between the two age groups. There were no differences in clinically relevant laboratory abnormalities between the age groups.

ADVERSE REACTIONS: LIPITOR is generally well-tolerated. Adverse reactions have usually been mild and transient. In controlled clinical studies of 2502 patients, <2% of patients were discontinued due to adverse experiences attributable to atorvastatin. The most frequent adverse events thought to be related to atorvastatin were constipation, flatulence, dyspepsia, and abdominal pain. **Clinical Adverse Experiences** — Adverse experiences reported in ≥2% of patients in placebo-controlled clinical studies of atorvastatin, regardless of causality assessment, are shown in the following table.

| Adverse Events in Placebo-Controlled Studies (% of Patients) | | | | | |
|--|---------|--------------|--------------|--------------|--------------|
| BODY SYSTEM | Placebo | Atorvastatin | Atorvastatin | Atorvastatin | Atorvastatin |
| Adverse Event | | 10 mg | 20 mg | 40 mg | 80 mg |
| | N = 270 | N = 863 | N = 36 | N = 79 | N = 94 |
| BODY AS A WHOLE | | | | | |
| Infection | 10.0 | 10.3 | 2.8 | 10.1 | 7.4 |
| Headache | 7.0 | 5.4 | 16.7 | 2.5 | 6.4 |
| Accidental Injury | 3.7 | 4.2 | 0.0 | 1.3 | 3.2 |
| Flu Syndrome | 1.9 | 2.2 | 0.0 | 2.5 | 3.2 |
| Abdominal Pain | 0.7 | 2.8 | 0.0 | 3.8 | 2.1 |
| Back Pain | 3.0 | 2.8 | 0.0 | 3.8 | 1.1 |
| Allergic Reaction | 2.6 | 0.9 | 2.8 | 1.3 | 0.0 |
| Asthenia | 1.9 | 2.2 | 0.0 | 3.8 | 0.0 |
| DIGESTIVE SYSTEM | | | | | |
| Constipation | 1.8 | 2.1 | 0.0 | 2.5 | 1.1 |
| Diarrhea | 1.5 | 2.7 | 0.0 | 3.8 | 5.3 |
| Dyspepsia | 4.1 | 2.3 | 2.8 | 1.3 | 2.1 |
| Flatulence | 3.3 | 2.1 | 2.8 | 1.3 | 1.1 |
| RESPIRATORY SYSTEM | | | | | |
| Sinusitis | 2.6 | 2.8 | 0.0 | 2.5 | 6.4 |
| Pharyngitis | 1.5 | 2.5 | 0.0 | 1.3 | 2.1 |
| SKIN AND APPENDAGES | | | | | |
| Rash | 0.7 | 3.9 | 2.8 | 3.8 | 1.1 |
| MUSCULOSKELETAL SYSTEM | | | | | |
| Arthralgia | 1.5 | 2.0 | 0.0 | 5.1 | 0.0 |
| Myalgia | 1.1 | 3.2 | 5.6 | 1.3 | 0.0 |

The following adverse events were reported, regardless of causality assessment in patients treated with atorvastatin in clinical trials. The events in *italics* occurred in ≥2% of patients and the events in plain type occurred in <2% of patients.

Body as a Whole: *Chest pain*, face edema, fever, neck rigidity, malaise, photosensitivity reaction, generalized edema. **Digestive System:** *Nausea*, gastroenteritis, liver function tests abnormal, colitis, vomiting, gastritis, dry mouth, rectal hemorrhage, esophagitis, eructation, glossitis, mouth ulceration, anorexia, increased appetite, stomatitis, biliary pain, cheilitis, duodenal ulcer, dysphagia, enteritis, melena, gum hemorrhage, stomach ulcer, tenesmus, ulcerative stomatitis, hepatitis, pancreatitis, cholestatic jaundice. **Respiratory System:** *Bronchitis, rhinitis*, pneumonia, dyspnea, asthma, epistaxis. **Nervous System:** *Insomnia, dizziness, paresthesia, somnolence, amnesia, abnormal dreams, libido decreased, emotional lability, incoordination, peripheral neuropathy, torticollis, facial paralysis, hyperkinesia, depression, hypesthesia, hypertonia*. **Musculoskeletal System:** *Arthritis*, leg cramps, bursitis, tenosynovitis, myasthenia, tendinous contraction, myositis. **Skin and Appendages:** *Pruritus*, contact dermatitis, alopecia, dry skin, sweating, acne, urticaria, eczema, seborrhea, skin ulcer. **Urogenital System:** *Urinary tract infection*, urinary frequency, cystitis, hematuria, impotence, dysuria, kidney calculus, nocturia, epididymitis, fibrocystic breast, vaginal hemorrhage, albuminuria, breast enlargement, metrorrhagia, nephritis, urinary incontinence, urinary retention, urinary urgency, abnormal ejaculation, uterine hemorrhage. **Special Senses:** *Amblyopia, tinnitus, dry eyes, refraction disorder, eye hemorrhage, deafness, glaucoma, parosmia, taste loss, taste perversion*. **Cardiovascular System:** *Palpitation, vasodilatation, syncope, migraine, postural hypotension, phlebitis, arrhythmia, angina pectoris, hypertension*. **Metabolic and Nutritional Disorders:** *Peripheral edema, hyperglycemia, creatine phosphokinase increased, gout, weight gain, hypoglycemia*. **Hemic and Lymphatic System:** *Ecchymosis, anemia, lymphadenopathy, thrombocytopenia, petechia*. **Postintroduction Reports** — Adverse events associated with LIPITOR therapy reported since market introduction, that are not listed above, regardless of causality assessment, include the following: anaphylaxis, angioneurotic edema, bullous rashes (including erythema multiforme, Stevens-Johnson syndrome, and toxic epidermal necrolysis), and rhabdomyolysis. **Pediatric Patients (ages 10-17 years)** In a 26-week controlled study in boys and postmenarchal girls (n=140), the safety and tolerability profile of LIPITOR 10 to 20 mg daily was generally similar to that of placebo (see CLINICAL PHARMACOLOGY, *Clinical Studies* section in full prescribing information and PRECAUTIONS, *Pediatric Use*).

OVERDOSAGE: There is no specific treatment for atorvastatin overdose. In the event of an overdose, the patient should be treated symptomatically, and supportive measures instituted as required. Due to extensive drug binding to plasma proteins, hemodialysis is not expected to significantly enhance atorvastatin clearance.

Please see full prescribing information for additional information about LIPITOR.

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Pharmaceuticals

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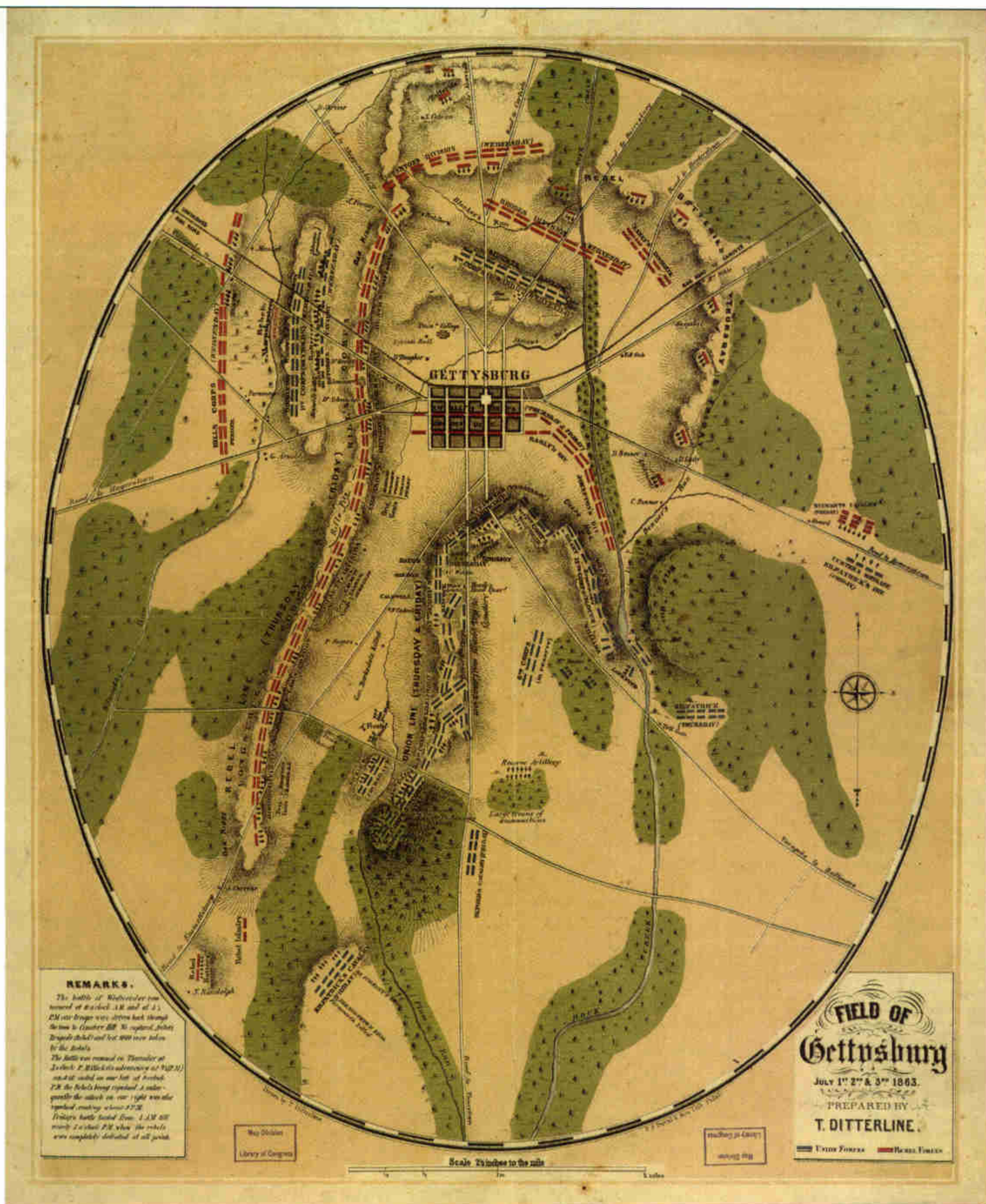
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Battlegrounds

A new look at geography's impact on war

"Mountains are greater obstacles than rivers," Napoleon said. "One can always cross a river, but not a mountain." Like all great generals, he knew that the enemy in

most conflicts is terrain as much as it is the opposing army. A Pennsylvania rise—Little Round Top (above)—may have changed the course of the 1863 Battle of Gettysburg, and possibly of the

entire Civil War. In *Battlegrounds: Geography and the History of Warfare* (\$35), new from National Geographic Books, military writers re-tread the ground of some of the critical battles of the past, from Alexander the Great's victories to Norman Schwarzkopf's Desert Saber. Available at shopng.com or wherever books are sold.



Manipur Brow-Antlered Deer
(*Cervus eldi eldi*)

Size: Head and body length, 180 cm; tail, 20 cm; shoulder height, 107-115 cm

Weight: 80-150 kg

Habitat: The state of Manipur in northeastern India

Surviving number:
Estimated at 180

Photographed by Anup Shah

WILDLIFE AS CANON SEES IT

Which is stronger, the heart or the stomach? India's Manipur brow-antlered deer tested that question—with nearly fatal results. The graceful creature has always won hearts, with popular local legends proclaiming it a binding force between humans and nature. Yet poachers once pursued it so ravenously that by the mid-1900s it was believed to be extinct. A tiny population has since been found in the wild, and poachers no longer target this

much-loved symbol of Manipur's cultural heritage. With small numbers and a severely constrained habitat, however, the Manipur brow-antlered deer has not escaped the shadow of extinction.

As an active, committed global corporation, we join worldwide efforts to promote awareness of endangered species. Just one way we are working to make the world a better place—today and tomorrow.



NG TELEVISION & FILM SPECIAL ON PBS

On the Road to Mecca

TV crew documents Islam's holy pilgrimage

"In Saudi Arabia it's really sunny in February, so many women carry umbrellas. But I couldn't do that and carry the microphone at the same time," says filmmaker Anisa Mehdi, explaining why her headgear wasn't exactly standard issue for a pilgrimage to Mecca (below). Anisa not only produced *Inside Mecca*, the National Geographic Television & Film documentary exploring Islam's great pilgrimage; she also helped record its sound. Shadowing convert Fidelma O'Leary from her home in Texas to Mecca,

Anisa and her team joined more than two million Muslims on their trip to the holy city. Many pilgrims climbed the Mount of Mercy—where the Prophet Muhammad gave his last sermon—and made personal confessions to God. "The cameras captured people weeping out of sorrow for things they had done wrong," says Anisa. "They hold up their hands, in supplication, hoping God's mercy will rain down." The show airs on October 22 at 8 p.m. ET/PT on PBS stations nationwide (check local listings).



KHALED AL-FAL

SPECIAL EDITION POSTER

Parallel Universe



NGM P10

"The only way to keep up with zebras is with a four-wheel drive," says Anup Shah, who with his brother, Manoj, photographed "Zebras: Born to Roam" in last month's issue of NATIONAL GEOGRAPHIC. The magazine's latest poster pick is their photograph of mothers and foals trotting in the morning light in Kenya's Masai Mara National Reserve. Mothers keep their offspring close—and chase other zebras away—so foals learn to recognize mom's smell, sound, and stripes.

The poster is available for \$39.95 plus \$6.95 for shipping (\$9.95 for international orders). Please add appropriate sales tax for orders sent to CA, DC, FL, KY, MI, PA, VA, VT, and Canada. We will produce only as many 24-by-30-inch posters as we receive orders for by October 31, 2003. Each will be hand-numbered and embossed with the Society seal. Shipping is scheduled for December 2003. Call toll free: 1-888-647-7301 (outside the U.S. and Canada call 1-515-362-3353) or order online at nationalgeographic.com/ngm.

GET MORE

To learn more about a subject covered in this issue, try these National Geographic Society products and services. Call 1-888-225-5647 or log on to nationalgeographic.com for more information.



SAUDI ARABIA (PAGE 2)

- **Hadj: Journey of a Lifetime** on the National Geographic Channel, October 9, 8 p.m. ET/PT. Follow three Muslims from Britain—a young Egyptian woman, an Asian father traveling with his son, and a Western convert—as they make the pilgrimage to Mecca, Islam's holy city.
- **Cradle and Crucible: History and Faith in the Middle East.** Photos and essays on the cultural, political, and religious forces that have shaped the region since prehistoric times (\$30).
- **National Geographic Atlas of the Middle East.** Detailed maps of 16 nations, the West Bank, and the Gaza Strip, plus information on oil, water, religions, and more (\$19.95 soft-cover; members-only hardcover edition available for \$24.95. Call 1-888-647-6733).

Who Knew?

CELLULAR IMAGING

The Glow-in-the-Dark Brain

Brought to you by a jellyfish

Shelley Halpain makes bright, vivid movies of brain cells growing, and here's what she sees:

At first a brain cell looks like a fried egg. It quivers, then sends out tendrils. The tendrils wriggle, extend, and then retract, an out-and-back motion that Halpain describes as saltatory. You might just say they're salsa dancing.

One tendril becomes an axon, a conduit for transmitting signals to other brain cells. Axons explore their terrain intrepidly, hoping to link up with other cells. The rest of the tendrils become dendrites; they stay near home, waiting to spark a relationship with any axon that might come wandering by.

Halpain, a neuroscientist at the Scripps Research Institute in San Diego, wants to figure out how a tendril knows to become an axon instead of a dendrite. What compels the brain to organize itself in such a fashion? Who's driving the bus?

These questions will likely take years of research to answer. In the meantime Halpain's movies take advantage of a tool that radically improves her ability to see brain cells developing in real time. It's a fluorescent protein from a jellyfish.

For years scientists had struggled to see how brain cells grow. Researchers had been chemically attaching fluorescent molecules to proteins,

then injecting the concoctions into a cell, but this laborious process often killed the cell before experiments could even begin.

Then came *Aequorea victoria*, a glowing jellyfish that lives in the North Pacific. Scientists were able to isolate a fluorescent protein in *Aequorea*, and using their collective genius, they came up with a name for it: green fluorescent protein.

GFP, as it's more commonly called, is barrel-shaped and hollow in the center. Right smack in the middle is the fluorophore—the glowing part of the protein. (Did we say barrel? It's really a lantern.)

By 1995 researchers had figured out how to clone the gene that produces the protein and had developed a technique for successfully transferring the gene into brain cells so that they, too, would become intrinsically fluorescent.

The gene is now manufactured in test tubes using bacterial cultures, and no jellyfish need be sacrificed on behalf of neuroscience.

No doubt people will continue to find creative and slightly weird uses for the protein lantern. Someone had the bright idea of genetically engineering a mouse that produces GFP throughout its body. Under

certain lighting these mice glow faintly green. (You can see where this will lead. Coming soon to a mall near you: roving packs of fluorescent green teenagers.)

Even Hollywood has found clever ways to use GFP. Did you see the cameo by *Aequorea* at the beginning of *Hulk*? Now we know the Hulk's true color: jellyfish green.

—Joel Achenbach

WASHINGTON POST STAFF WRITER



IT MATTERS

It's not easy coming up with a list of good things about jellyfish.

Swimmers hate them because they can ruin a day at the beach; fishermen hate them because they clog their nets. But jellyfish provide us with more than just glowing proteins for lab experiments. To those living around the northern Pacific Rim—in Japan, Russia, Alaska, and Canada—jellyfish matter because they're a major item on the daily menu of chum salmon. Chum have really big guts to handle their jelly-heavy diets, and though they may not be as famous as their Atlantic or sockeye kin, chum salmon account for more than a third of the world's wild salmon catch. It's a food chain thing: More jellyfish for hungry salmon equals more salmon for hungry humans.

—Hillel J. Hoffmann

WEBSITE EXCLUSIVE

Learn more about *Aequorea* and other jellyfish—and find links to Joel Achenbach's work—at nationalgeographic.com/ngm/resources/0310.



Wielding royal authority, Prince Mishaal bin Abdul Aziz celebrates the end of a camel festival in Hafar al Batin by performing the *ardha*, or sword dance.

KINGDOM ON EDGE Saudi. Arabia

Torn between ancient traditions and the modern world, Saudis search for balance in the post-9/11 glare.



New horizons: Riyadh was a quiet outpost until the mid-20th century, when money poured into this oil-rich nation and began transforming its capital into a showy megapolis. Today Saudis find themselves speeding by Kingdom Centre (right), an ultramodern hotel and office complex that boasts luxury apartments, sports clubs, and one entire floor reserved for women only—where veils are optional.



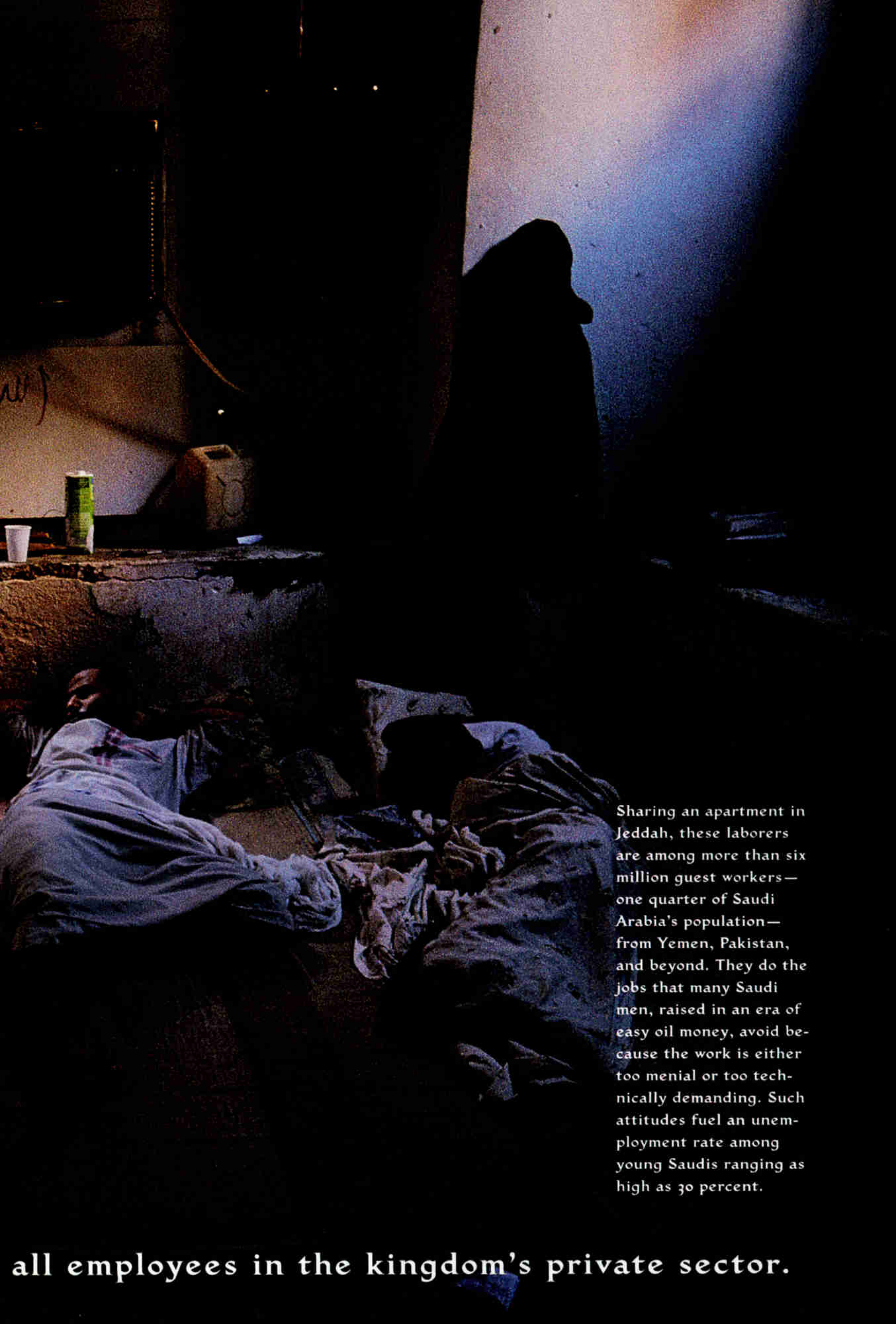
Arabia has seen more change in the past six



decades than in the previous 13 centuries.



Foreigners make up more than 90 percent of



Sharing an apartment in Jeddah, these laborers are among more than six million guest workers—one quarter of Saudi Arabia's population—from Yemen, Pakistan, and beyond. They do the jobs that many Saudi men, raised in an era of easy oil money, avoid because the work is either too menial or too technically demanding. Such attitudes fuel an unemployment rate among young Saudis ranging as high as 30 percent.

all employees in the kingdom's private sector.

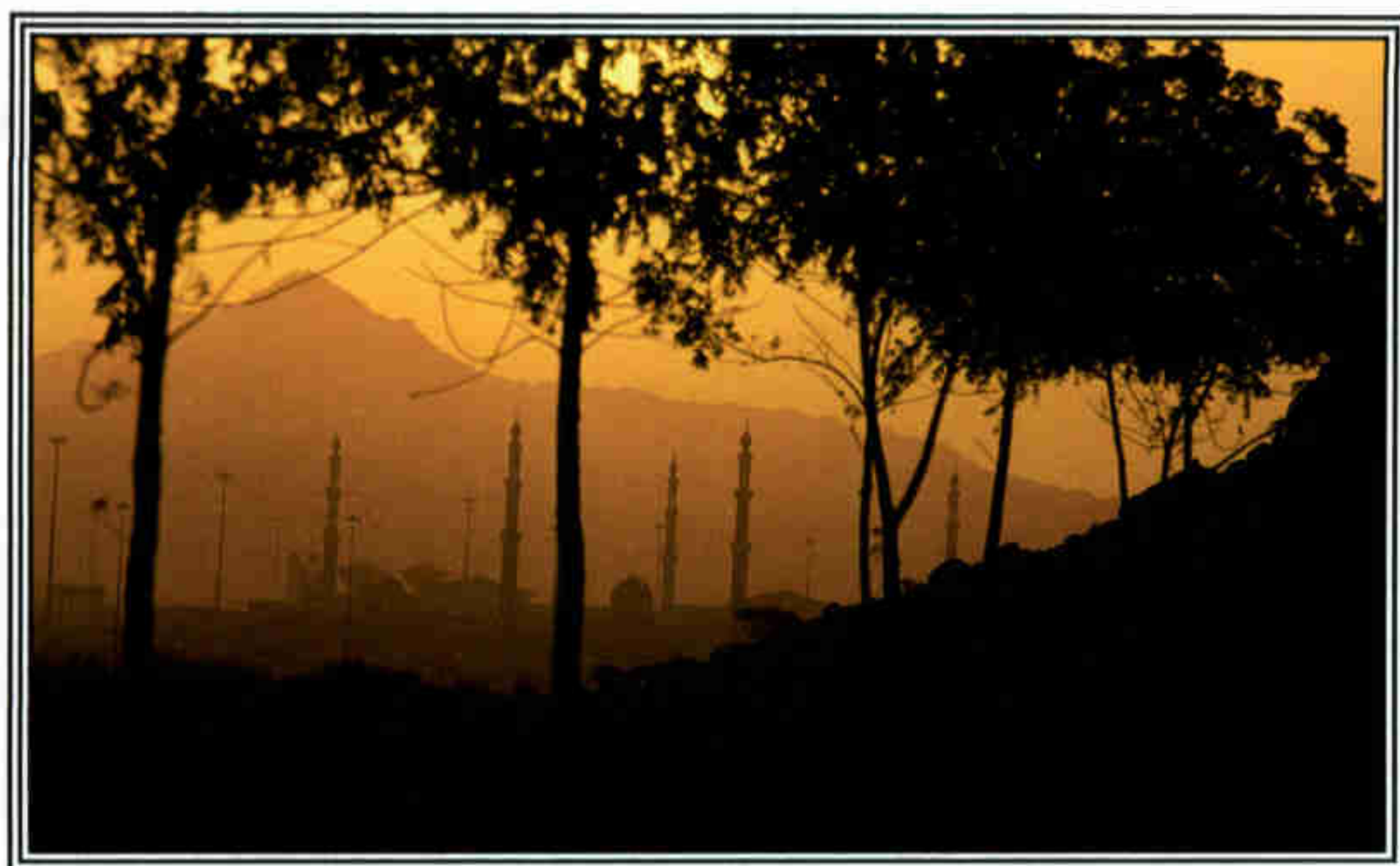


"Modern" in Saudi Arabia came to mean



Where camels once trekked, cars now gather, ferrying more than a million people each year to the Jenadriyah Heritage and Cultural Festival near Riyadh. First held in 1986 and organized by the Saudi National Guard, this two-week event celebrates local traditions—crafts, music, camel racing, and more—that are central to the Saudi identity.

American modern—the mass-consumer version.



On the Plain of Arafat, near Namira mosque (above), the Prophet Muhammad delivered his last sermon in 632: “No . . . apostle will come after me, and no new faith will be born.” This revelation still anchors Saudi Arabia, Islam’s historic epicenter.

At high noon, the streets of central Jeddah are empty, silent, vacant of all but the occasional lonely passerby to remind me that more than two million people live in the apartment towers and neighborhoods that radiate out from the shores of the Red Sea. This is the second largest city in the Kingdom of Saudi Arabia, its commercial engine and busiest port, its most cosmopolitan metropolis. But now, during the holy month of Ramadan, every sensual pleasure—including eating and drinking—is banned from dawn to dusk, and Saudis stay indoors to pray and fast, or to catch a nap in the cool, dark recesses of their homes. For hours each day, there are no signs of life outdoors, no stirring but a breeze, no movement but heat waves shimmering over asphalt in the broiling Arabian sun.

Nights are a different matter.

As soon as the sun drops below the horizon, urban Saudi Arabia emerges with a sleepy yawn, then *flings itself* into a frenzy of socializing, shopping, and gargantuan feasts of dining. During the holy month, it’s hard to find an à la carte menu in the restaurants of Jeddah; the all-night, all-you-can-eat Ramadan buffet is the norm, at

tables groaning under 24-ounce steaks, mountainous platters of lobster, and roasted 30-pound quarters of mutton.

At 3 a.m. miles of freeways and boulevards are locked in a traffic jam of gas-guzzling, mostly American, cars headed for shopping malls that remain open until sunup. Macho sport utility vehicles are the ride of choice among affluent young men, Lincolns and Chevys among their parents. In the malls, store aisles throb with music videos blasting out techno and rap as salesmen hawk subscriptions to satellite television—technically illegal in Saudi Arabia—with a success rate that has made satellite dishes ubiquitous on the rooftops of Saudi cities. If not for the neon signs in Arabic, the streets of Jeddah tonight could pass for downtown Los Angeles or Dallas or Houston.

Up and down chic Tahliyah Street, carloads of teenage boys, with baseball caps worn rakishly backward and their ankle-length robes tossed aside in favor of baggy, low-slung pants, idle alongside cars full of teenage girls driven by chauffeurs.

As I take in the scene with “Hassan” (not his real name), my 18-year-old guide, a green Chevy slowly passes a silver Jeep Cherokee, and a

blizzard of paper flies between their vehicles.

"What was that all about?" I ask.

"They're 'numbering,'" Hassan explains. "A girl writes her cell phone number on a piece of paper, rolls it into a ball, and throws it at a boy. Then she waits for a call."

But the flirting, with its paper-wad blizzards and cell phone dates, has a distinctive Saudi twist: The girls are still covered from head-to-foot in the black gown known as the *abaya*, their faces hidden behind veils.

"Otherwise the *mutawaeen* might go after them," Hassan says, referring to the state religious police, the agents of a theocratic law-and-order system that dates back more than a thousand years.

Jeddah, in the middle of the night, is the paradox of contemporary Saudi Arabia writ large. "We are being carried in two directions at once, backward and forward," says Suad al-Yamani, a Saudi neurologist who sees, in her patients, the disorienting effects of changes that have rocketed a deeply conservative society from the 7th to the 21st century in the span of a few decades.

The stakes are beyond exaggeration, for Saudi Arabia is not simply another traditional country coping with change. As keeper of the Muslim holy cities, Mecca and Medina, it serves as the chief custodian of Islam and the spiritual home of 1.3 billion Muslims worldwide.

Ruled by a tribal monarchy and governed by sharia, or Islamic law, Saudi Arabia is a major ally of the United States and the source of 25 percent of the world's confirmed oil reserves, which has made its royal family extraordinarily affluent, influential, and resented.

It is also the birthplace of Osama bin Laden and 15 of the September 11 hijackers—a nation accused of fomenting terrorism, yet itself haunted by the menace of bin Laden's al Qaeda movement and terrorist attacks such as the bombings in the capital, Riyadh, five months ago that killed 34 people, Saudis and foreigners alike.

Today Saudi Arabia is at the center of a cultural and geopolitical maelstrom, where Islam meets the modern world, where tribal custom meets cell phone consumerism, where fabulous wealth meets uncertainty and alienation. What happens to the oil-rich Saudis, as they wrestle with their own dire confusions in the heartland of Islam, sends tremors all over the Earth.

This is what brought me to Arabia, and why, one winter morning, I found myself in a car climbing east with two Saudi companions into the province of Al Bahah, one of the kingdom's most obscure regions, a land of amorphous towns and barren ridges that was home to several of the September 11 hijackers.

The mountain road inland from the Red Sea was a serpentine gauntlet of police checkpoints, three in a single 12-mile stretch. As we reached the city of Al Bahah, the provincial capital, the thickest fog I'd ever seen closed in, and we could barely spot the last few roadblocks, manned by Bedouin policemen dancing from foot to foot in an effort to keep warm. The fog never lifted, and, apart from government officials, the cops were among the few Saudis out in public. Al Bahah was a surrealistic cityscape where cafés and restaurants were manned by Afghan cooks, barbers and mechanics were Indians and Turks, and taxis were driven by Pakistanis or Egyptians.

"Saudis don't like it here, sir," a cabbie from Peshawar told me. "Too wet and cold, and there is no work that suits them."

The government puts the number of guest workers in Saudi Arabia at more than six million—nearly half the kingdom's working-age population. Their ranks include an elite class of physicians, engineers, scientific researchers, and corporate managers, who are provided with luxurious housing, stratospheric salaries, and annual two-month paid vacations from their jobs in cities such as Riyadh, Jeddah, and Dhahran.

Places like Al Bahah, however, are the realm of thousands of Third World guest workers, an inexhaustible pool of truck drivers and factory hands, manual laborers and domestics, shop clerks and secretaries, who welcome the jobs that many young Saudis don't want.

Bored young people with too much time on their hands: This is what the Saudis themselves regard as their seminal crisis, sown in the clash between borrowed modernization and threatened traditions—the root crisis from which a forest of others has sprung.

"The hijackers were a direct product of our social failures—a generation with no sense of what work entails, raised in a system that operated as a welfare state," a high-ranking

BACKGROUND DESIGN (ABOVE): "THE HOUSE OF SAUD," IN ARABIC. CALLIGRAPHY BY MAMOUN SAKKAL.



Islam's animating principle is a direct


government official told me. "We allowed them to grow up in pampered emptiness, until they turned to the bin Laden extremists in an effort to find themselves."

Saudis claim that al Qaeda deliberately fills its ranks with the kingdom's alienated young. Bin Laden's goal, they believe, is to topple the Saudi royal family, partly by convincing the West that its principal source of oil is fatally infected with extremism.

"We are not a nation of terrorists and fanatics. You cannot blame an entire people for a crime perpetrated by a small number of marginal individuals," contended Prince Salman bin Abdul Aziz, the governor of Riyadh.

"The crazies around my age, the people who say, 'We should go out and kill Americans,' are maybe one or two percent of us," said "Mustafa," a 22-year-old I met during my tour of Jeddah's Ramadan nightlife.

But Mustafa, like so many in his age group, has no job and no discernible ambition. Estimates of unemployment among Saudis top 15 percent, and approach 30 percent among those between ages 20 and 24. Each year about 340,000 Saudi men enter the workforce, vying for just 175,000 jobs. The unsuccessful drift into an ever growing army of the bored, spending their days and nights in the *prolonged adolescence of the shopping mall circuit, numbering and street cruising.*



The way of Islam colors every detail of life in the kingdom, where tones of devotion echo from mosque to public square, and the Koran is the law of the land. Birthplace of the Prophet Muhammad, Saudi Arabia walks the narrow path set down by 18th-century reformer Muhammad ibn Abd al-Wahhab, whose stern dictates regarding infidels, women, conversion, and righteousness still grip the kingdom today.

could go straight from school to an executive suite. "They imagined that it would be a society of all chiefs and no Indians," Prince Alwaleed bin Talal, a leading real estate developer and entrepreneur, told the *Arab News* last year.

Now, say economists, something has to give, starting with an educational system that fails to meet the demands of modern industry. "The companies who come to us are looking for skilled workers, business grads, engineers, and technicians," said Nasser Salih al-Homoud, director of an unemployment office in Buraydah, a quiet farming center of 350,000 in central Saudi Arabia. Few Saudis qualify.

One of his clients is Abdulrahman al-Ali, 25. "I've been trying to find a job for a year," he told me. "When I submit an application, people tell me they'll call, but they never do." The problem is his schooling: Like many young Saudis, al-Ali has a bachelor's degree in Islamic philosophy.

The fulcrum of Saudi history can be pinpointed exactly: the Persian Gulf city of Dammam on March 3, 1938, when American engineers unleashed the kingdom's first commercially viable oil gusher after 15 months of drilling. The joint venture between U.S. petroleum companies and Saudi Arabia's ruler, King Abdul Aziz ibn Saud, put the fledgling nation on the global economic map.

Ibn Saud had launched his conquest of Arabia three decades earlier. Initially he led just a few dozen men against the ruling Al Rasheed clan, who had driven the rival Sauds into exile

relationship between believers and God.

The solution would seem obvious: Replace foreign workers with Saudis. Under a policy known as Saudization, the government has been trying to do exactly that since the mid-1980s. The state grants large interest-free loans to any citizen who wants to establish a private business, and offers salaries to students willing to undertake vocational training. The goal is to replace 60 percent of the foreign workers with Saudi nationals, in jobs ranging from taxi driver to administrative manager. But two decades into the policy, foreigners still make up more than 90 percent of all employees in the kingdom's private sector.

Until recently, every young Saudi thought he

in 1891 and seized control of Nadj, the area surrounding the caravan crossroads of Riyadh, and the Al Qasim region to its north. The Al Rasheeds were allied with the Turkish Ottoman Empire, which then governed the Red Sea coast, including Jeddah, Mecca, and Medina, while the Sauds were buoyed by alliances of their own. One was with followers of Muhammad ibn Abd al-Wahhab, the charismatic 18th-century religious reformer whose fervor helped propel the Sauds to power and defined their view of Islam and the world. The other was with Britain, whose support during and after the fall of the Ottoman Empire in World War I made the Saudi state possible.



Prince Mishaal—14th son of the late King Abdul Aziz ibn Saud—presides while seated at a *majlis*, a gathering where citizens can directly petition their leaders for help, advice, or some emergency cash. While Saudi Arabia has always been governed by the Saud clan, this family affair has never been so big: The kingdom now supports more than 5,000 princes.

The echoes spoke of a peculiarly Saudi version



of democracy with its roots in the desert.

During the first three decades of the 20th century, Ibn Saud's forces and territory steadily grew as he combined brilliant military campaigns with adept diplomacy—and strategic marriage pacts with other tribes—to expand his realm to its present borders.

In 1933, a year after Saudi Arabia was founded with Riyadh as its capital, Ibn Saud granted an exclusive oil exploration concession to the Standard Oil Company of California. The partnership evolved into Saudi Aramco, the government-controlled enterprise that now presides over some 260 billion barrels of oil reserves and 225 trillion cubic feet of natural gas—and accounts for about three-quarters of the kingdom's revenue. This vast wealth has funded the Arab world's most modern and well-equipped military force, a monumental welfare system, a network of religious missionaries dispersed throughout the Muslim world, and spectacular royal residences in Beverly Hills, London, and the south of France.

From the moment the oil concession was granted, “modern” in Saudi Arabia came to mean American modern—and more precisely, the outsize, mass-consumer version of modern that American oilmen carried with them from the U.S. Southwest, primarily Texas. Even apart from oil, the fit was in some ways natural. Like Texas, Saudi Arabia juxtaposes a long humid sea coast and a huge arid interior scorched by extreme desert temperatures. Between its 1,600 miles of Red Sea and Persian Gulf beaches lie 865,000 square miles of flat desert plains and mountains, more than three times the size of Texas itself and two and a half times the combined size of Germany and France.

It would be impossible to exaggerate the shock waves that the discovery of oil sent through this landscape—and the life of its inhabitants. The Arabian Peninsula has seen more change in the past six decades than in the previous 13 centuries. As recently as 1950, Riyadh was a sleepy oasis town of 60,000 inhabitants, most of them still living in mud-brick houses. Then came the 1970s oil boom, and with it a construction binge unlike anything the Middle East had ever seen. In the estimate of its harried Urban Development Authority officials, Riyadh now houses four and a half million people, and is well on the way to becoming an Arabian megalopolis.



THE WORK OF GOD: ELEPHANT ROCK AT MADAIN SALIH



THE HAND OF MAN: STONE HOUSES ON A MOUNTAIN NEAR YEMEN



THE CURRENTS OF CHANGE: MAKING WAVES ON THE RED SEA COAST

But Texas-style gigantism doesn't end there. A modest house in the Riyadh scheme of things —“where normal people live,” as an Urban Development official put it—measures 5,000 square feet, roughly five times the size of a middle-class home in Western Europe and palatial even by Texas standards. Far larger residences are by no means unusual. “I'd like to show you my new house,” a mid-level government bureaucrat told me one day in Riyadh. “The construction is almost finished.” When we arrived, I mistook it for an apartment complex; it covered more than 25,000 square feet, spread across half a dozen buildings lined from ceiling to floor in imported rose marble.

The Saudis claim that they need the space—in part because up to four generations customarily



inhabit the same home, and because of the sky-high fertility rate. The kingdom's estimated population has ballooned from 6.2 million in 1970 to 24 million in 2003, one of the steepest increases on Earth. The average Saudi woman bears more than six children.

They are born to a society forged in the austere universe of the desert, governed by a single family and grown overnight into a network of awkward 21st-century cities. It's a society that can seem mute from a distance—across the gulf of ignorance and caricature that envelops Western views of the kingdom—or at best speaks only in the official voice of an autocratic state.

Closer up, I found, Saudi Arabia is a babel of contentious opinion, even in its most remote desert encampments.

The wilderness reserve of Uruq Bani Maarid lies 320 miles south of Riyadh, in the shelter of towering dunes that mark the western perimeter of the Rub al Khali, the Empty Quarter, the enormous desert the Bedouin know simply as the Sands. But it's not empty for the Yam tribesmen who live there. Since time immemorial they have crossed the Sands' 225,000-square-mile desert in search of water and forage for their camels and sheep.

Zafer al-Fahd was raised in one of the black Yam tents that was pitched near a ranger post the week I traveled to the Empty Quarter. At 27 he had never experienced the contradictions of Ramadan in urban Saudi Arabia and said that he had no desire to. "The Sands are enough for any man," he told me.

It was just past dawn. As Zafer built a fire in the entrance to the tent to stave off the morning chill and make breakfast, teenage boys hammered out a drum rhythm in brass mortars, grinding down coffee beans.

"My heart is at rest in the Sands," he continued. "I know how to read the desert winds when I graze my animals. I know how to find my way through the dunes at night by keeping al-Jedi before me: That one, the 'goat star,'" he said, pointing into the northern sky.

There are no reliable statistics on how many Bedouin are fully nomadic today. (Saudis acknowledge that their country's mirage-like census is a demographer's Empty Quarter.)

The sweet scent of burning sandalwood perfumes the desert air for a Bedouin near the border with Iraq, where tribal leaders meet at the tent of a prominent sheikh to share a campfire, break bread, swap stories, and debate news of the day.



"What matters most to us are your ancestors."

A half-century ago, the best guess was that 30 percent of the population, about two million people, lived the desert wanderer's life. In the estimate of Saudi ethnologist Ali al-Ambar, the figure has dropped to roughly 600,000.

A far greater number have become what al-Ambar refers to as "semi-nomads" herding their flocks on the outer economic orbit of mushrooming cities, or "urbanized" Bedouin who work city jobs but retain ancestral tribal customs. Taken together, these three communities still make up more than half Saudi Arabia's total population and a large share of its self-image. Despite the kingdom's precipitous urbanization, the free-ranging spirit of Bedouin culture

remains at the core of traditional Saudi identity.

Slowly, other men drifted into the tent where I sat with Zafer. They gathered in *halaqah*, small conversational groups, relaxing on pillows around the tent's margins. The talk was of hunting and camel-raising, and, when I brought the subject up, the essential values of the Bedouin.

"What matters most to us are your ancestors, who they were," one man said. "Without a tribe, a person is suspect."

The elder seated next to him took immediate issue. "No, I don't agree. The important thing is what you yourself do in this world, not who your grandparents were. It is you who must choose between good and evil."



Without a tribe, a person is suspect.”

I heard echoes of that conversation everywhere I went in the kingdom, traveling through 11 of its 13 provinces over a four-month period from Ramadan to the hajj. The echoes spoke of a peculiarly Saudi version of democracy with its roots in the desert, an incessant and open-ended debate that resounds throughout the larger society.

“The first thing any Saudi does when he builds a new home, even in a big city,” al-Ambar had said to me, “is to put a tent in the garden, or a figurative version of it in the house.”

Those figurative tents were of a piece architecturally: large rooms lined with chairs and sofas; the institution they serve is the *majlis*, a social

gathering for the purpose of conversation and counsel. A majlis may also amount to an official audience, especially if its host is powerful.

His Royal Highness Abdullah bin Abdul Aziz al-Saud, Crown Prince, Regent, First Deputy Prime Minister and Commander of Saudi Arabia’s National Guard, is distinctly powerful. He is effectively the acting monarch, in place of his ailing half brother King Fahd, who suffered a debilitating stroke in 1995. One morning I attended his weekly majlis with Majed al-Jarralah, 30, and Riyadh bin Salmah, 25, Saudi friends who were my companions on



The free-ranging spirit of Bedouin culture



The atmosphere is competitive (and downwind, a bit ripe) at a camel beauty contest near Hafar al Batin. Hundreds of breeders parade thousands of camels before a handful of judges. The right look—big eyes, a droopy lower lip, a long thin neck, and a high fleshy hump—can pay off handsomely: One breeder was offered, but declined, a million dollars for his prize camel.

remains at the core of Saudi identity.



Saudis claim that al Qaeda deliberately fills

the journey across their kingdom.

With al Qaeda thought to be preparing new attacks, security was heavy at the entrance to the crown prince's wing at National Guard headquarters. Yet inside, notwithstanding the splendor of a majlis hall that measured well over a thousand square feet and was furnished in the style of a Louis XIV salon, the casual pattern borrowed from the desert was unmistakable.

We watched an elderly man, with the leathery weathered skin of a desert herdsman, as he approached Abdullah. They shook hands, and the herdsman sat down next to his nation's ruler to discuss a problem man-to-man, patting the crown prince on the arm from time to time to emphasize key points.

"He may be asking permission to graze his sheep on royal land," one bystander whispered in my ear as we discreetly tried to eavesdrop. "Some people just drop in to say hello," Riyadh added. "Or even to ask his opinion on their marriage problems."

No preliminary interviews are conducted before the royal audiences, which are held by every princely official in the nation. Anyone is free to attend, and it's not unusual for a Bedouin

camel herder with grazing complaints to precede a billionaire property baron who needs a construction permit. In both cases, the prince listens attentively and then assigns the matter to one of the aides who stand beside him during the majlis.

Beyond the palace walls, the range of such meetings is endless. Some are neighborhood meetings aimed at sorting out local disputes. At others, intellectuals and writers meet businessmen and engineers, or bureaucrats compare notes on the problems of government with their retired predecessors.

As at the royal majlis, the resonance with the tents of the Bedouin past is inescapable. Men wander in at the end of the day, shake hands all around, then join conversation circles over cups of brain-charging Arabic coffee, sugary dates, and heavily sweetened ginger tea.

At one majlis, I asked a noted Muslim scholar, an imam, how Islam's venerable assertion of religious tolerance could be reconciled with Saudi Arabia's ban on Christian churches in the kingdom.

"It was the command of God, conveyed to us through the Prophet Muhammad, that no other



its ranks with the kingdom's alienated young.

To defend their homeland, Saudis rely on imported weapons—from guns brandished by a security detail (opposite) to jet trainers like one on display at a festival (above). But many Muslims resent having foreign soldiers stationed on Saudi soil, which prompted the United States to redeploy part of its force to neighboring Qatar earlier this year.

religion be permitted in the land where Islam was born,” the imam replied.

To my surprise, another guest picked a point-for-point argument with him. “I’ve heard that allusion a hundred times, and nobody has ever convinced me that this is what the Prophet’s words really meant,” he said.

It is in these gatherings that competing visions for the kingdom’s future are being imagined and discussed. In their updated Bedouin encampments, the Saudis are negotiating their own way through a perilous landscape, where old assumptions are being challenged along ancient roads in the birthplace of Islam.

From a passenger plane descending into Medina under a full January moon, the Prophet’s Mosque was a dazzling rectangle of white light, pulsating several thousand feet below at the city’s heart. An hour later I was under its minarets, walking slowly

across a vast square of polished marble in sight of the tomb of Muhammad, which is what makes Medina the second holiest site in the Islamic world, after Mecca.

Majed and Riyadh and I had driven into Medina from the airstrip, until we reached an area several blocks from the city center that was flooded with people making their way toward the mosque. We parked the car and joined them.

The first days of the hajj, the annual pilgrimage that marks a lifetime’s spiritual goal for Muslims and draws more than two million people each year to Mecca and Medina, were upon us.

Many of the pilgrims around me were Saudis and Arabs from the Persian Gulf. But among them were throngs of Indonesians and Malays, Algerians and Moroccans, Senegalese and Nigerians, Somalis, Uzbeks, Pakistanis and Bangladeshis, Turks with red crescent-moon flags embroidered on their shirts, Chinese in yellow

Pearly lights of Shaybah oil field shine like jewels in the crown of Saudi Arabia, which controls one-fourth of the Earth's known oil reserves. Its unrivaled ability to quickly increase or decrease the world's supply of energy has made the kingdom a prized ally for the U.S. and other Western nations, whose interest in Saudi political stability goes well beneath the surface.



"We should have used our oil wealth to



create a genuinely modern society.”



“We are being carried in two directions

windbreakers stamped with the logos of Xinjiang travel agencies.

There were as many women as men in that crowd, marching forward to the Prophet's tomb in the great egalitarian pageant that is Muhammad's chief legacy. Islam is a religion without an institutionalized church, without a Vatican, without a formal priesthood; its animating principle is a direct relationship between believers and God, a personal relationship that transcends race, class, and gender.

The faces around me were a study in raptured meditation, and in the immense silence that enveloped the Prophet's Mosque, I fell into a reflective trance of my own. Then Riyadh, whose father is an official of the hajj, gently touched my arm. “Now, my friend,” he asked. “Do you understand?”

Riyadh's question was a central theme of my quest in his country: trying to understand the coexistence of Islam's rich worldwide diversity—its private song to God in 1.3 billion voices—and the monotone religious orthodoxy that prevails in the kingdom itself.

Most Saudi interpretations of Islam in 2003 still sound the puritanical chord struck over

two centuries ago by Muhammad ibn Abd al-Wahhab, the religious reformer whose alliance with the Saud clan bestowed religious legitimacy on the Saudis and enormous political power on Wahhab's followers.

Today, in mosques all over the country and in Saudi-funded religious schools throughout the Muslim world, clerics advocate Wahhab's stern program, which is based on a return to the “pure” Islam practiced during the Prophet's time. Its spirit is at fierce odds with the consumerism that has erupted in Saudi Arabia since oil was discovered, and—fundamentalists charge—with the lavish lifestyles of the Saudi royal family.

Though public criticism of the monarchy is rare, some clerics do speak out on political topics in voices that can veer toward the fanatical. More common are the virulently anti-Western sermons that bolster Osama bin Laden's portrait of an Islamic holy land surrendered to foreign corruption.

Caught in the crossfire are the vast majority of Saudis, and none more vulnerably than the kingdom's women. Wafa M. is a 26-year-old science



at once, backward and forward.”

Mesbah Hejazi struggles with disabling arthritis, diabetes, epilepsy, and poverty, but she doesn’t struggle alone: The government pays a doctor to make house calls (above), part of national health care that’s free for all Saudis, rich or poor. Relaxing in Jeddah (opposite), the Naqshabandi family can focus more on news about the war next door.

teacher so devoted to her profession that she makes a 200-mile round-trip five times a week from Jeddah to a rural high school near Medina that would have no biology department without her. That alone puts her on the leading edge of change in a society where half of all women were illiterate as recently as the mid-1990s.

By law, however, she can’t drive a car; she’s ferried to the school in a chauffeured minivan with four other female teachers. She cannot walk the streets of her city unveiled or unchaperoned without risking confrontation with the mutawaeen. She cannot travel abroad without a *mahram*, a male guardian from her immediate family.

Like the overwhelming presence of foreign workers in the kingdom’s streets, the overwhelming absence of women in public can be jarring to outsiders, no matter how prepared they are to encounter Saudi misogyny. It is as though the traveler enters a half-populated landscape, in which 50 percent of the human race has been relegated


to faceless shadows that flit discreetly along the margins of activity, or black-veiled wraiths who toss numbered paper wads to teenage boys in hope of a disembodied flirtation by cell phone.

The chief enforcer of constraints on Saudi women, in the simple caricature of Saudi society, is the domineering husband, a staunch ally of the religious police who stalk the streets in search of “immodest” women.

But real life is seldom so simple: It was Wafa’s husband, Saad, who organized my surreptitious meeting with his wife in a Starbucks café, encouraging her to remove her veil and allow this article’s photographer, Reza, to take her photo.

“I just can’t do it,” Wafa finally said. Reza left, and the veil remained in place throughout our two-hour conversation over caffe latte, as the couple’s five-month-old daughter, Lana, gurgled happily in her mother’s lap and her two-year-old sister, Dina, squirmed for attention.

Wafa tried to explain. *(Continued on page 32)*



Arabian horses once galloped across an Islamic empire, marked by wealth and culture, that stretched from Spain to western China. Today in Saudi Arabia, the breed occupies a smaller stage—at racetracks, equestrian events, and stud farms like the one owned by Prince Sultan bin Abdul Aziz. By preserving the bloodline of Arabians, Saudis sustain a symbol of an earlier golden age.


The clash between modernism and tradition is



the root crisis from which others have sprung.



“We are not a nation of terrorists and



A whisper of unease—a feeling not uncommon among Saudis these days—touches the face of a fisherman on the Red Sea. With a labor force far better trained in theology than engineering, Saudi Arabia teems with unemployed young people who still expect oil money to keep them comfortable. As a result, says Saudi journalist Mohammed al-Khereiji, “a lot of young Saudis sit around doing nothing.”

fanatics. You cannot blame an entire people.”



Subversive counterinfluences are as

(Continued from page 27) “It’s not only a religious issue for me, and not even a civil liberties issue,” she said quietly. “It’s about our families, about what they’d say and think if someone saw me in your magazine. Things like that just aren’t done.”

A day earlier, Saad had briefly talked her into the photo. He’s a convincing guy, a 27-year-old public relations and advertising man, partly raised in the United States, who picked me up at my hotel wearing tan chinos and a button-down oxford shirt. But he’s not as convincing as Wafa’s parents, who had changed her mind the previous evening in a meeting at their home in Mecca.

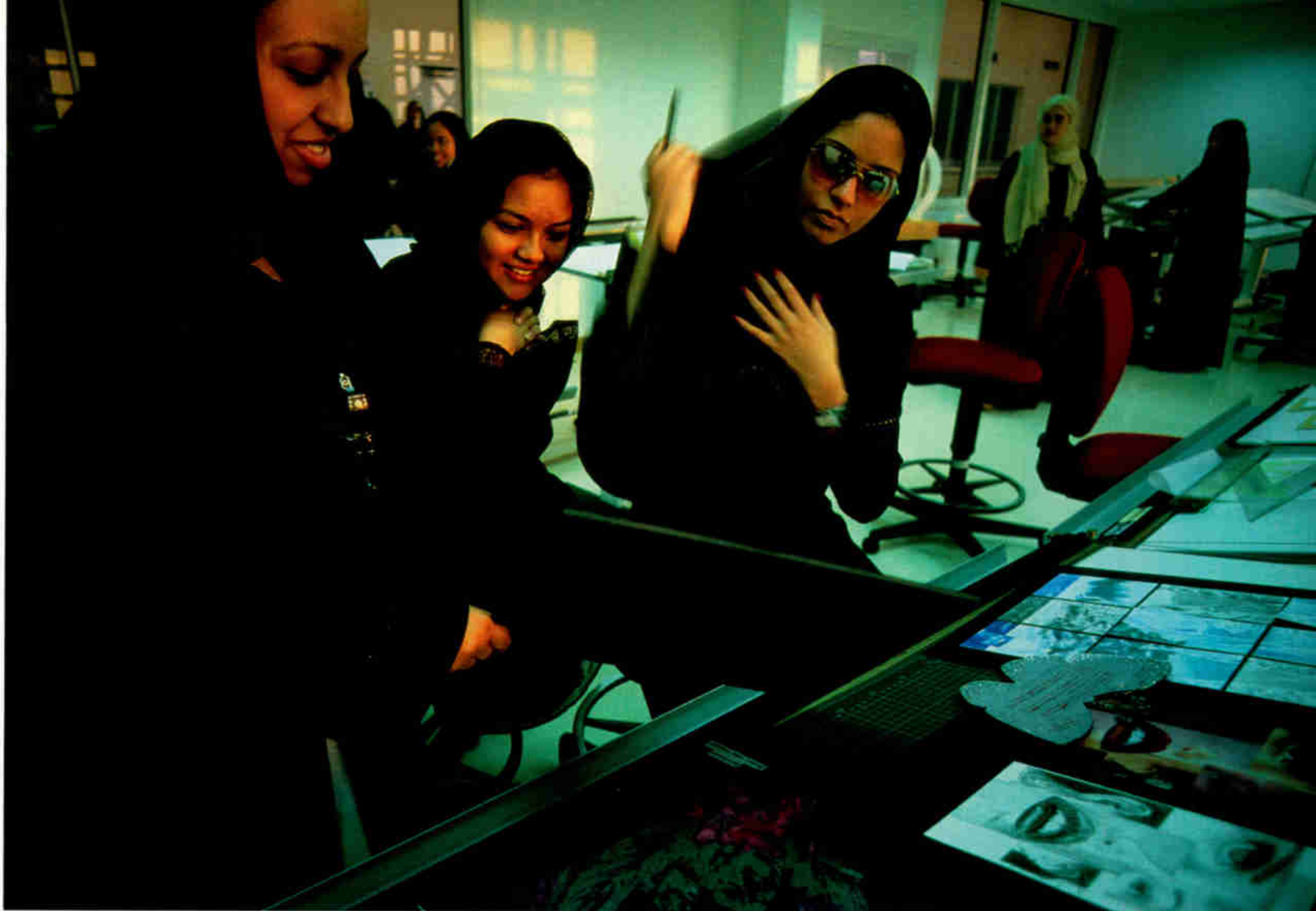
“The pressure to observe the old ways is exerted most powerfully at the level of the family,” notes Prince Abdullah bin Faisal bin Turki, a prominent spokesman for modernization. “To criticize those ways is to criticize your own parents and grandparents.”

Yet the old ways themselves were considerably looser a quarter century ago, before the Iranian Islamic revolution in 1979 pushed the entire Middle East toward more repressive social norms. Many Saudis on the Red Sea coast, where desert

custom is tempered by trade and the constant passage of foreign Muslims on the pilgrimage to Mecca and Medina, also blame the rise of Riyadh, which overtook mercantile Jeddah as the nation’s most important city in the 1970s. The capital is a chief stronghold of Wahhabism, the seat of the Committee for the Propagation of Virtue and the Prevention of Vice, also known as the mutawaeen, and of the powerful Ministry of Religious Affairs.

Subversive counterinfluences, however, are as close at hand as satellite television. To the daughters of traditional Arabia who sit glued each afternoon to uninhibited and wildly popular soap operas transmitted from Beirut and Cairo, the message is that women can be good Muslims and serve as government ministers; they can dress as they like, drive their own cars, and run their own businesses. They can dream. Which is one of the main reasons Wafa subjects herself to a 1,000-mile commute every week.

“The girls I teach are the daughters of peasant farmers,” she said. “I’m their window to a larger world. What I want for them, what I want for my own daughters, is the possibility to act on their dreams.”



close at hand as satellite television.

Students at Dar Al-Hekma, a women's college in Jeddah, can study nursing, management, and graphic design (above), but because of Saudi interpretations of sharia, or Islamic law, they cannot travel abroad without permission, appear in public unescorted, or drive a car. Men at a café in Al Khubar (opposite) idle on a very different road.

At a suburban estate north of the capital, I arrived before 8 p.m. for dinner and wound up in a conversation that proceeded, with great intensity, until I finally left for my hotel at 5 a.m.

"We have a village mentality, closed and fearful, even though most of us now live in cities," my host said at one point, trying to account for the walls built around his nation's women.

"We Saudis should have used our oil wealth to create a genuinely modern society, to promote real development," I was told in another sitting room, this time in downtown Riyadh. "Instead, we went on a five-star tourist trip, and now we're seeing the consequences."

Both men are royals in their 50s, and one is near the pinnacle of a very long line of succession emanating from Ibn Saud, who personally led the great Saudi baby boom, unifying his realm by fathering children with the daughters of as many tribal leaders as possible. Seventy

years after he founded the kingdom, the House of Saud counts more than 5,000 princes.

Hundreds of the royals attended universities in Europe and North America 30 years ago. When you visit their homes and discussion turns nostalgic, they are likely to dig out a Jefferson Airplane or Beatles album and put it on the stereo. Their mentality is a complex mixture of deep attachment to the traditional Arab values personified by the Saud family, and a thoroughly international outlook imparted by educations abroad during the 1960s and 1970s. Pulled, even more than their subjects, in two directions at once, their sense of crisis is acute.

"What happens here in the next five to fifteen years will be crucial," said Prince Faisal bin Abdullah, who invited me out for an evening's talk during Ramadan. We sat in his garden on the Red Sea shore north of Jeddah, sipping tea and snacking on pistachios and cashew nuts.

Faisal's official role is an administrative post



Swingers on a playground in Jeddah follow the rules: Saudi women must wear an *abaya*, or black cloak, in public; unrelated men must keep their distance. Monitoring public morals and fingering sinners, the Saudi religious police, or *mutawaeen*, make up the government's long-armed Committee for the Propagation of Virtue and the Prevention of Vice.

In public they are faceless shadows that flit

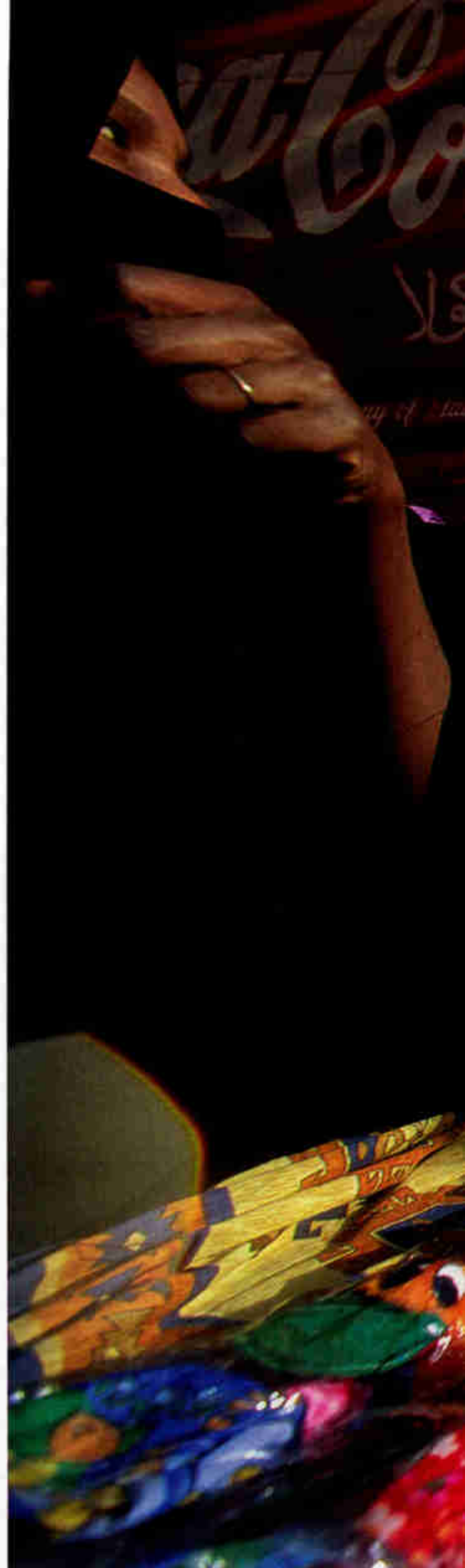


discreetly along the margins of activity.

in the National Guard, but his deeper ambition is to establish a network of think tanks for Saudi Arabia, modeled on those he encountered as a student at Stanford. He believes that only professional, scientific governance—in a word, technocracy—can thread a rational course between the dangers of both religious fanaticism and mindless mass consumption.

Many in the rising generation of leaders share this conclusion; in recent years they have energetically promoted the careers of skilled technocrats on their own staffs and throughout the bureaucracy. The flagship of their vision is the Majlis ash-Shura, a consultative assembly created by King Fahd in 1992 and installed in an

Despite the Che Guevara T-shirt (below), no socialist revolt is brewing. But anger is. Enraged by U.S. Mideast policy, some Saudis boycott U.S. brands like Coke, which markets Western tastes on the sidewalks of Mecca (right).



Saudi Arabia is in a cultural maelstrom, where

enormous domed hall on the grounds of the Royal Palace in Riyadh. The Shura is arguably the most educated government assembly ever to exist. Of its 120 members, 77 hold doctorates or medical degrees; 87 are graduates of major Western universities. Remarkably for Saudi Arabia, only 12 hold degrees in religious studies.

Although the Shura's members are now appointed by the King, some observers regard it as the forerunner of an elected legislature that will eventually share power with the monarchy. Not everyone agrees with that premise. But on one matter there is near unanimous agreement across the kingdom. Whoever leads Saudi Arabia, his most pressing task is to create an authentically

Saudi definition of progress to replace those simply borrowed or bought from someplace else.

The central square of Sabya, a farming town in the kingdom's rural south, was swarming with worshipers before Friday prayers when Jabbar Abdulghani bin Isa stepped from the rear of a police van. He expected it to be his final hour on Earth.

"Up ahead, just a hundred meters away beyond the mosque, I could see the executioner," he recalled. "I could see his sword glinting in the sun."

From the square's far side, Muhammad Banaygh watched. He had been waiting 17 years



tribalism meets cell phone consumerism.

for this moment, since the day that his father was killed in a fight with bin Isa.

"All of those years, my family had wanted his blood," he said, as we talked later in a hotel coffee shop. But as the crowd parted and his father's killer was led to the execution block, Banaygh suddenly decided that the shedding of more blood would solve nothing.

"I turned to my brother and my uncle and said, 'Let's stop it.'" They waved frantically to the officials in charge.

Sitting across the table from Banaygh and me in the coffee shop, the condemned man, bin Isa, described the next moments with the vividness of someone who had stared into the abyss of his

own death. "The crowd started clapping and one of my guards kissed me on the forehead. 'Praise God,' he said, 'it is His will that they have forgiven you.'"

Under sharia, the Koranic legal code that prevails in Saudi Arabia, the fate of convicted murderers is determined by the families of their victims, whose adult heirs cast votes on the sentence. For 17 years, through the three mandatory appeals required in all murder cases, Saudi magistrates had been working ceaselessly to nudge the Banayghs toward a pardon.

"The judges talked to us many, many times," Muhammad Banaygh said. "'To forgive or not is your right,' they explained. But they wanted



This is what Saudis see in their nation, and



The religious line in Saudi Arabia, including sermons to the faithful at the Prophet's Mosque in Medina, is set by Wahhabi clerics appointed by the government. Critics say this homegrown movement, which is also exported, is virulently anti-Western and incites terrorism; others say that imams who vilify Jews and Christians don't have much of a following—or a future.

their religion: a heavenly ordered state.

us to forgive, because that's what the Koran asks."

This is what Saudis see in their nation, and their religion—and what they would like the world to see as well. Not the hijackers of September 11, who branded the kingdom with the stigma of terrorism, but a heavenly ordered state in which mercy is a paramount virtue. Not the grim spectacle of a public beheading, but the intense faith that can halt it, based directly on the Prophet Muhammad's account of God's word as revealed to him on the Arabian Peninsula nearly 1,400 years ago and recorded in the Koran.

It is difficult today, in the fog of current events, to imagine how breathtakingly open and humane Islamic justice must have seemed at its inception, at a time when much of Europe was still reeling from the arbitrary whims of feudal lords.

Mercy and imagination, in fact, were once Arabian hallmarks, principal elements in the revolution wrought by the Prophet Muhammad in the era that Europe knew as the Dark Ages.

Those same centuries were a golden age for Arabs and Islam, an explosion of creativity marked by an openness to—even an obsession with—knowledge and science. Its principal discoveries were made in the ninth century, when scholars in Baghdad set about translating the chief scientific and philosophical works of foreign cultures and classical antiquity.

In concert with Indian mathematicians, Arab scholars perfected the modern numerical system, wrote the first treatise on algebra, and formalized the discipline of geometry. They made pioneering advances in astronomy and

Swirling winds in the mountainous Asir region are like religion and politics in Saudi Arabia—a potent force that's easier to feel than forecast. Will reformers find a modern path, or will the hardliners prevail? What about al Qaeda and the Saudi duel with terror? Faced with plenty of hard questions, will the Saudis look inward, or heavenward, for answers?

"If we are to survive as a nation, we have

physics, inspired by Greek texts that had been suppressed as "pagan heresy" in the West. Arabs invented the paper mill; its inexpensive substitute for parchment helped to launch the publishing industry.

"The highest achievements in science and technology were once found in the Islamic world," a senior figure in the Saudi bureaucracy said, as he took me on a tour of the King Abdul Aziz National Library in Riyadh, the country's largest library. "But that was a thousand years ago."

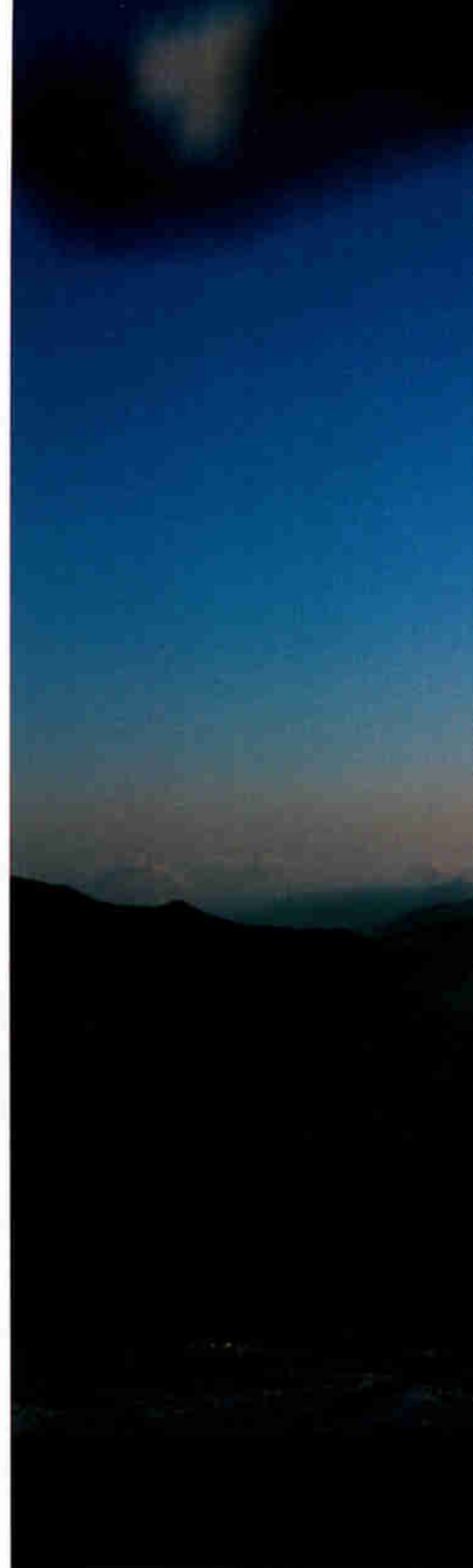
He gestured at the shelves around us. The collection, he pointed out, totaled 500,000 books—one-tenth the holdings of the main public library

in Cincinnati, Ohio. "More important, you'll find very few key recent works from Europe, America, or East Asia here."

The contrast with Islam's golden age is devastating. According to the UN, a scant 330 foreign books are translated into Arabic in an average year. In Spain alone, 16,750 foreign books were translated in 2001, more than the total for all Arab nations combined in the past 50 years.

"If we are to survive as a nation, we have to be fully part of the world again, fully engaged in it," my guide to the library said. "We have to rid ourselves of the belief that we can protect our culture, protect Islam, with closed minds."

It is a refrain that a visitor hears often in 2003,





to be fully part of the world again.”

an idea that is gaining momentum to counter the voices of extremism. A delegation of reform-minded Saudi professionals, intellectuals, government officials, and businessmen held an unprecedented private meeting earlier this year with Crown Prince Abdullah. In effect it was an emergency majlis, and its theme was the need for a new openness, buttressed by proposals for democratic elections, a dramatic reordering of the relations between men and women, and freedom of religion.

“The time has come to reinvigorate the national soul,” Abdullah himself declared in a speech a few days later, “[and] prove that Arabs are able to establish themselves as a living nation.”

I thought of Wafa, the science teacher, as I read Abdullah’s words, and of the proto-democracy I’d found among the Bedouin. A new golden age is being dreamed of in the kingdom, to reconcile the struggle between the past and the future, between the mutawaeen and the cell phone, between the seventh century of the Prophet and the fast-changing world of Muslims today. Its outcome will determine the future of Saudi Arabia, and quite possibly the future of Islam on this Earth. □

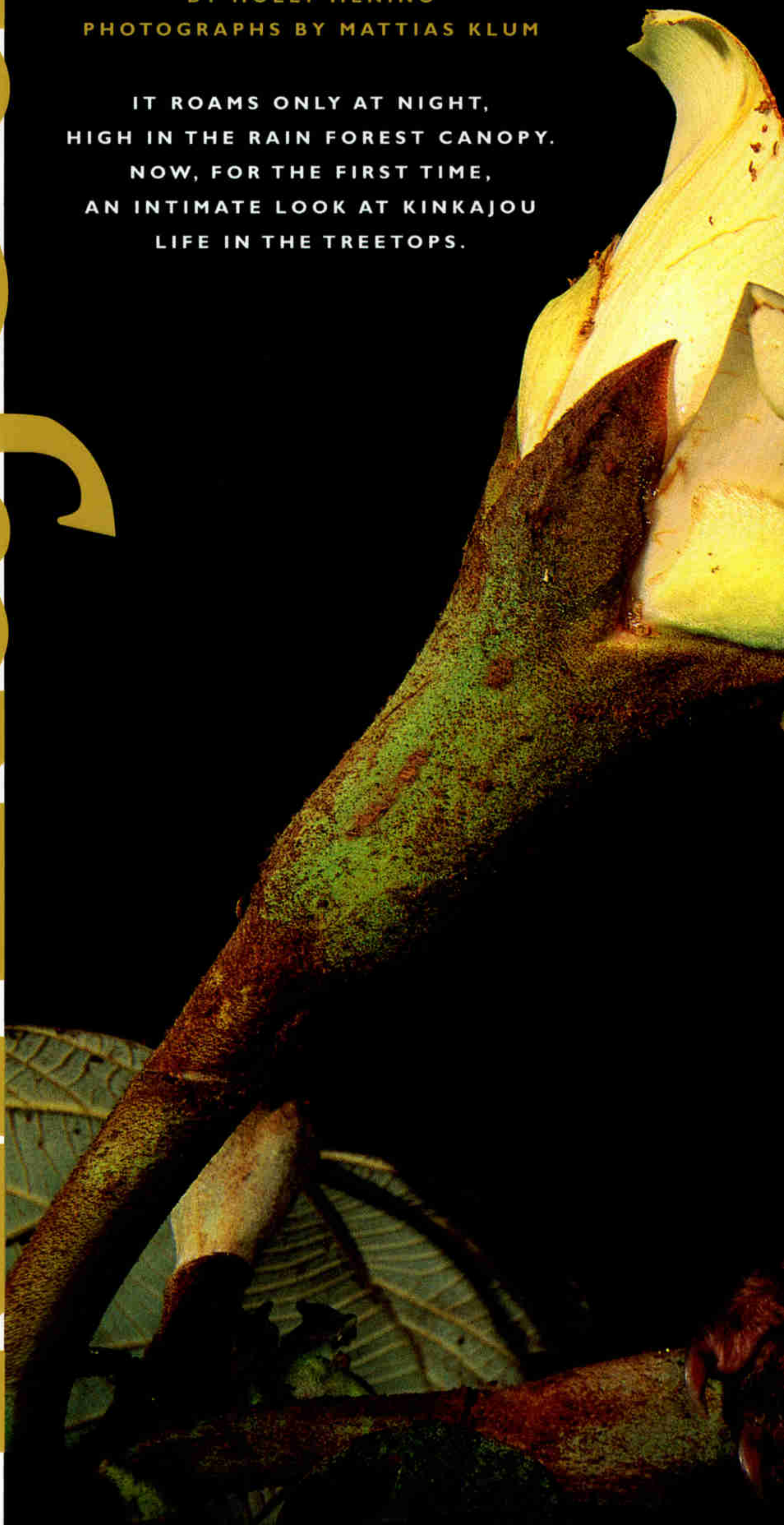
WEBSITE EXCLUSIVE

How hard is it to cover Saudi Arabia? Find out in tales from the field, see more of Reza’s images, and join a U.S.-Saudi forum at nationalgeographic.com/ngm/0310.

the kinkajou

BY HOLLY MENINO
PHOTOGRAPHS BY MATTIAS KLUM

IT ROAMS ONLY AT NIGHT,
HIGH IN THE RAIN FOREST CANOPY.
NOW, FOR THE FIRST TIME,
AN INTIMATE LOOK AT KINKAJOU
LIFE IN THE TREETOPS.





SERIOUS CLAWS AND ROUNDED
EARS EARNED IT THE
NICKNAME HONEY BEAR, AND ITS
AGILE HANDS AND BRANCH-
GRASPING TAIL SUGGEST
A MONKEY. BUT THE KINKAJOU
ACTUALLY BELONGS TO
THE RACCOON FAMILY.





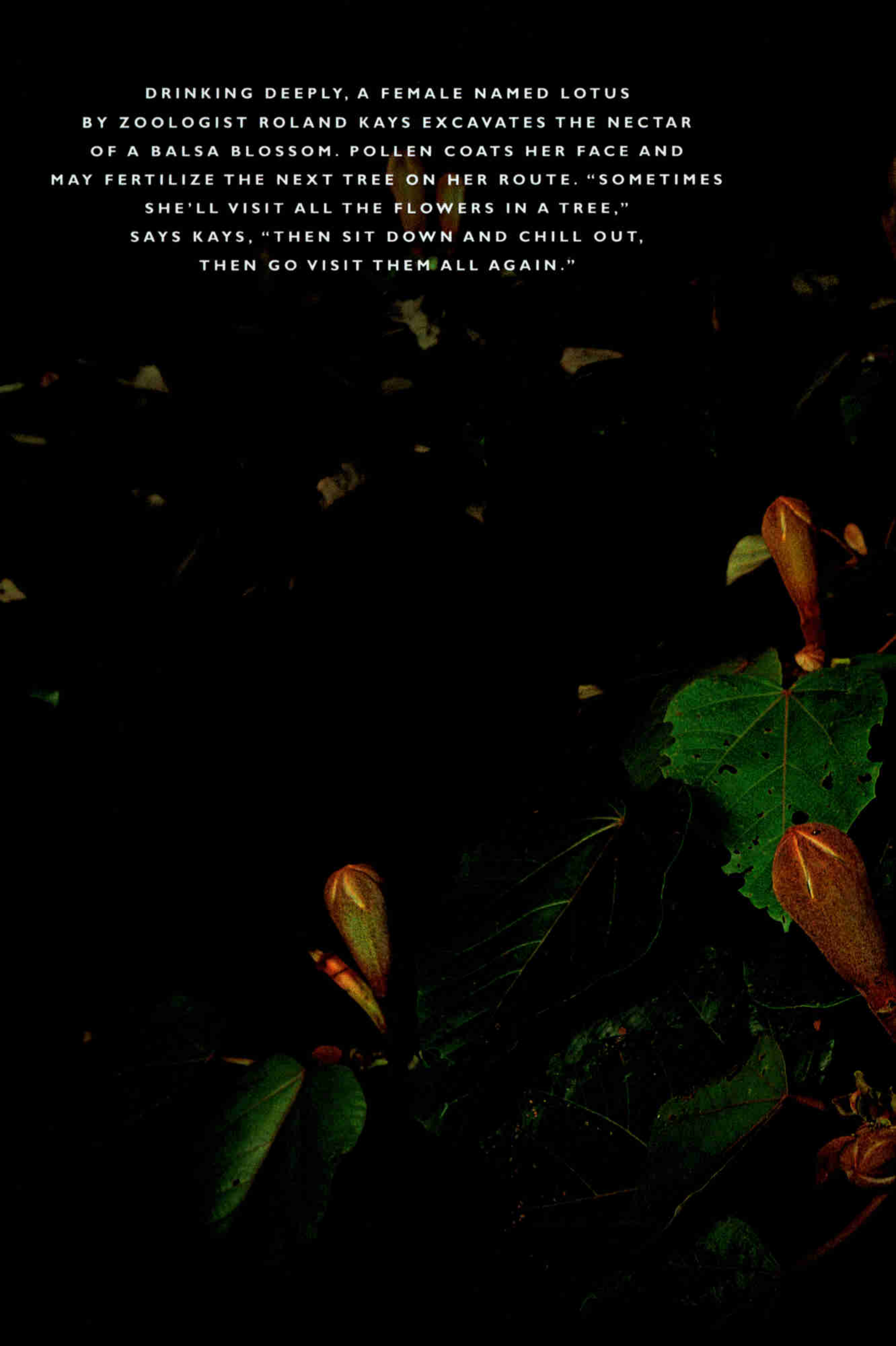
| THE KINKS |

“At night you hear them call,” says photographer Mattias Klum. “It’s a short, barking *wee-wee-wee* that seems to say, This is my tree, stay out of it.” But after any initial suspicion, kinkajous had no problem sharing their trees with humans willing to camp on their own level, a hundred feet above the ground in Panama’s rain forest canopy. Klum and his assistant spent night after humid night perched on branches of flowering balsa trees, wearing camouflage clothing and scanning the forest with night-vision goggles. “At first we stayed at least 20 feet from the blossoms where they came to feed,” says Klum. “Once they accepted us, we moved closer and closer. There was a real connection.”

Klum was working in the research territory of zoologist Roland Kays of the New York State Museum, who began his study in Panama ten years ago. Back then, little was known about the behavior of kinks (as Kays likes to call them) in their New World tropical habitat. About the size of a small house cat, they have few predators. “If you can find them,” says Kays, “they don’t run away.”

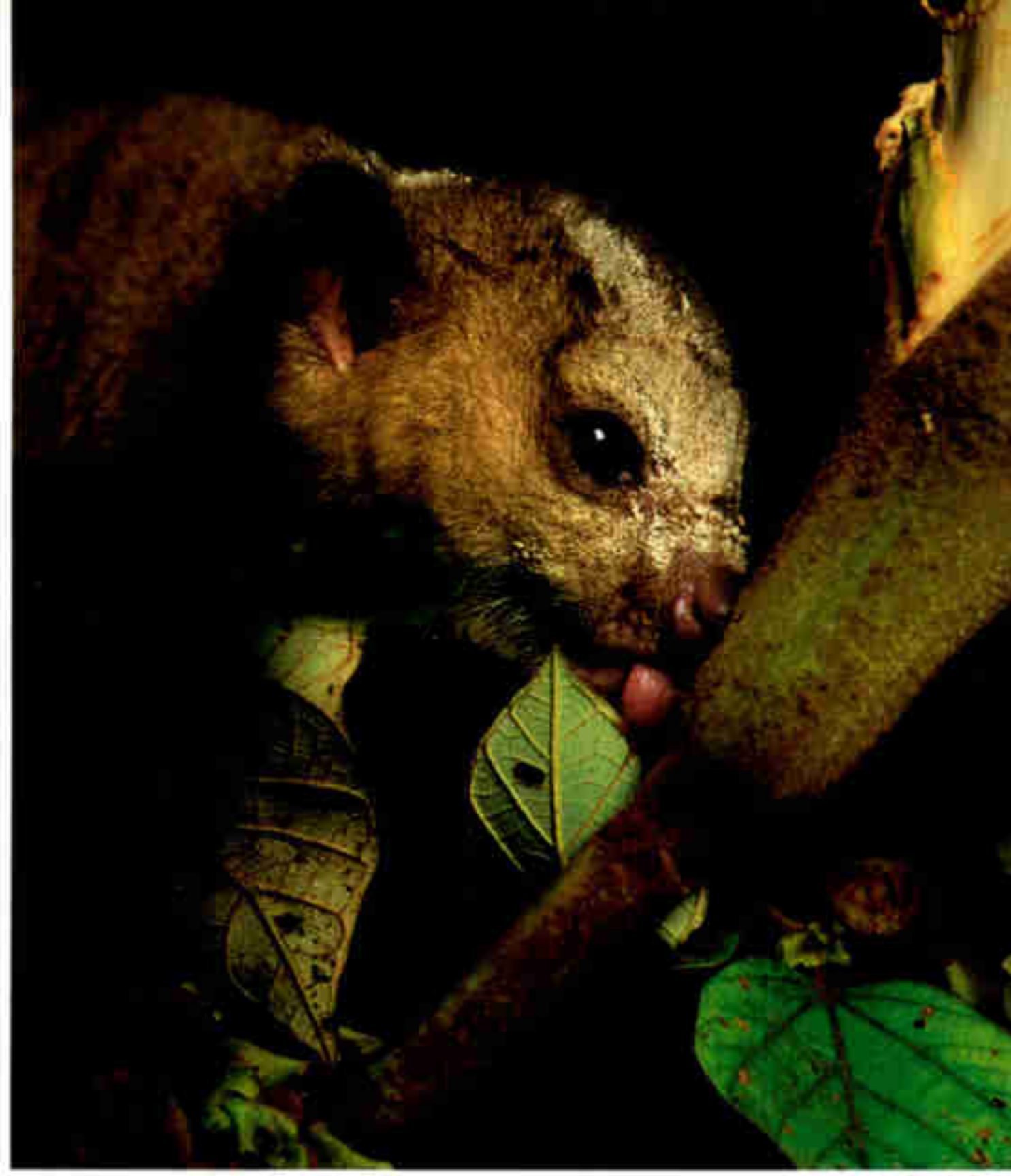


DRINKING DEEPLY, A FEMALE NAMED LOTUS
BY ZOOLOGIST ROLAND KAYS EXCAVATES THE NECTAR
OF A Balsa Blossom. Pollen coats her face and
may fertilize the next tree on her route. "Sometimes
she'll visit all the flowers in a tree,"
says Kays, "then sit down and chill out,
then go visit them all again."



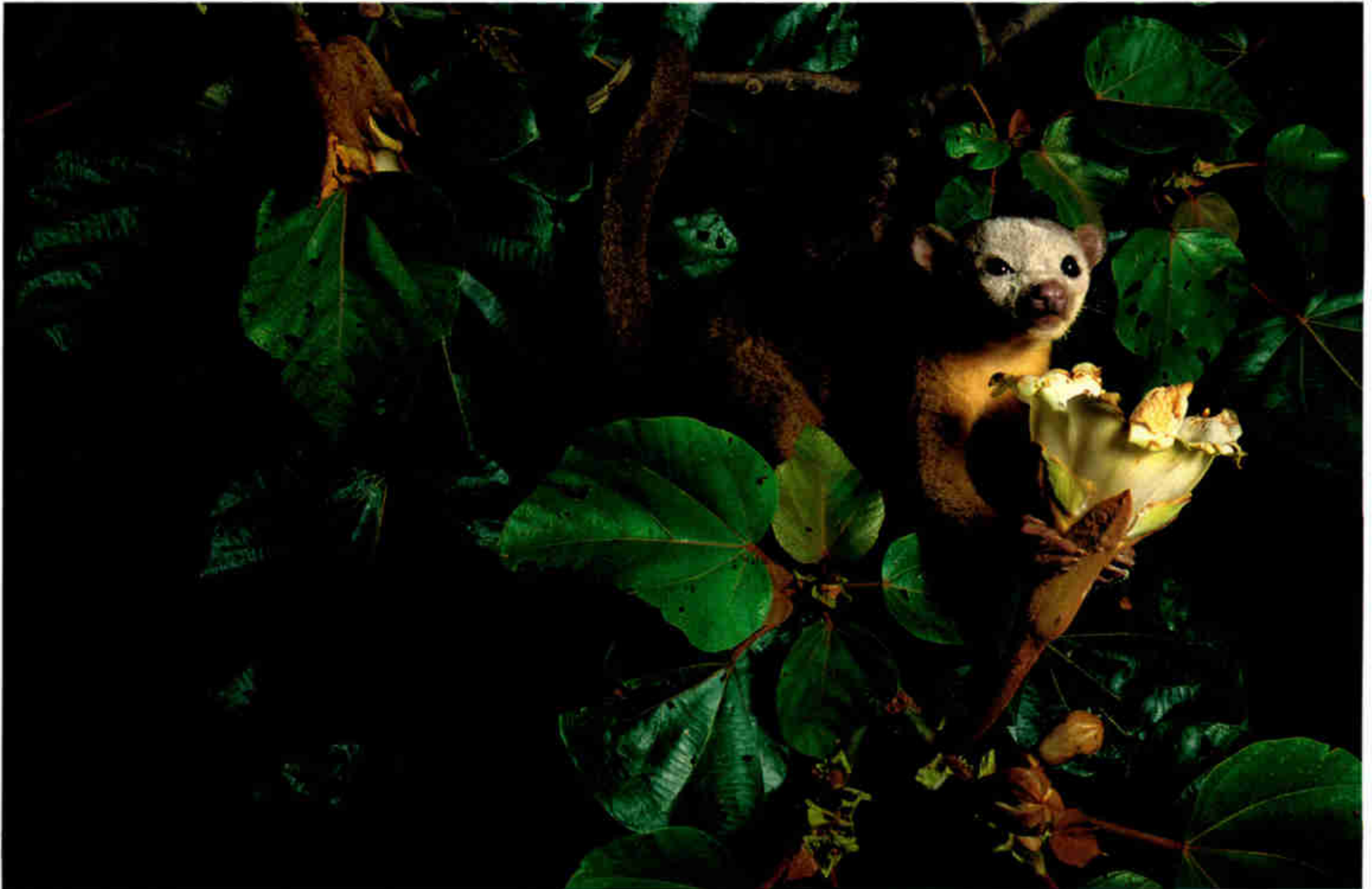






| SWEET BEAKS |

IN CERTAIN Balsa buds photographer Mattias Klum noticed holes he thought too small to come from kinkajou bites. Later he nabbed the culprits: orange-chinned parakeets stealing nectar without pollinating the plant in return. Kinks come along and lick up the leftovers (above), a side dish to the main, face-dusting meal (below).



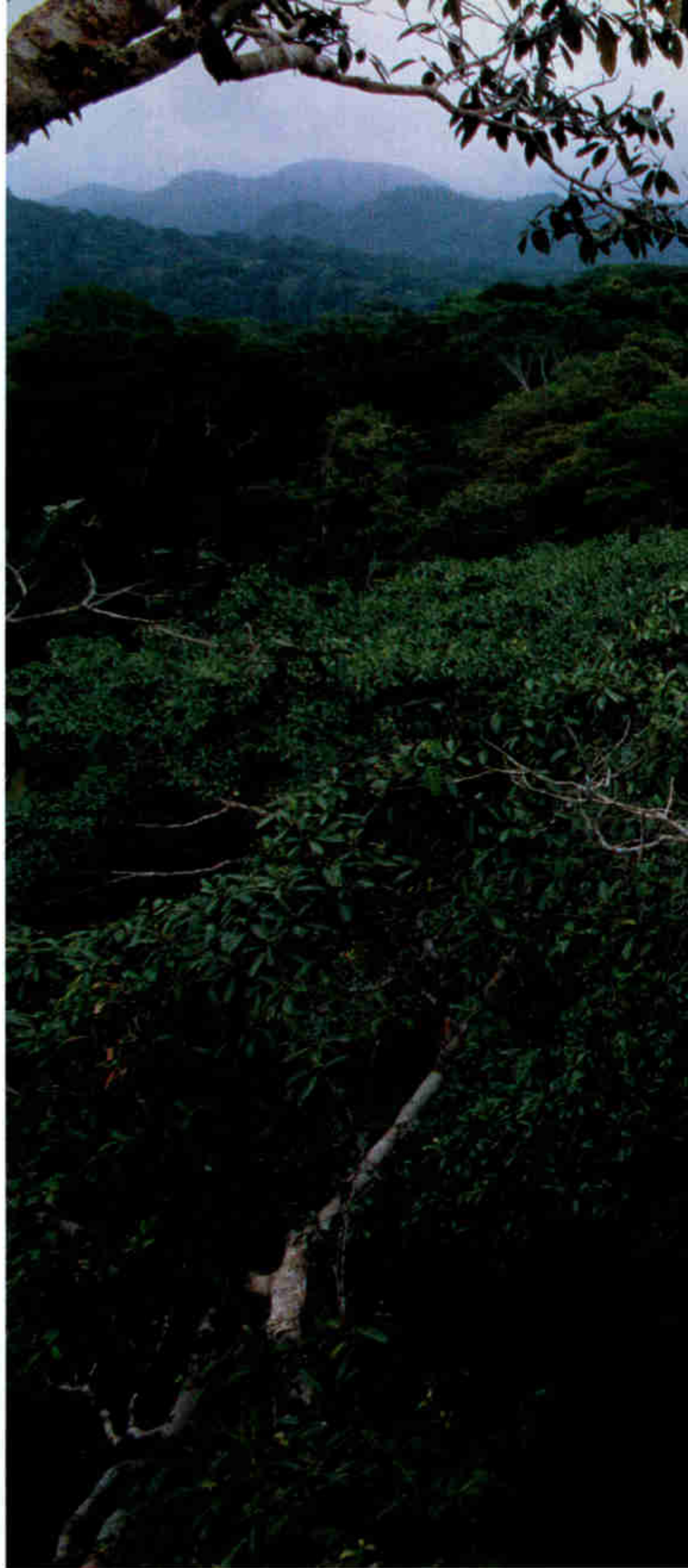
Not rare, but hard to find.

That's the dilemma Roland Kays faced when he began to study *Potos flavus* in Soberanía National Park near the Panama Canal. "Everyone assumed they were solitary, because you usually find them alone," he explains. But no one knew what was actually going on up in the canopy at night. Kinkajous rarely come to ground, and they sleep all day in tree holes. So how to fit them with radio collars for tracking? Kays devised a system for hoisting traps into trees. Next problem: How to lure kinks into the traps? They're classified as carnivores because of their skull structure and teeth, so Kays tried chicken as bait. No takers. He'd heard reports of pet kinkajous raiding owners' liquor cabinets, so he tried fruity peach schnapps. The kinks abstained. Then he considered the novelty of bananas, which don't grow in this forest. The kinks bit.

Kays's research, partly funded by the National Geographic Society, shows that kinkajous here live almost entirely on fruit, especially wild figs. They lap supplemental balsa-flower nectar with a long tongue. "Ecologically, they aren't carnivores," he says. Using DNA and radio-tracking—and following the kinks for neck-craning hours with flashlight and binoculars—Kays discovered an unusual social structure. A female, two males, a subadult, and a juvenile typically make up a family, sleeping together and grooming one another but usually foraging separately. Unlike most mammals, it's the female that leaves home when sexually mature, at about two and a half years. The turf passes from father to sons, and males develop stronger bonds than females. "Once I saw a father and young male playing in a fig tree," says Kays. "They were hanging by their tails and boxing each other in the head."

WEBSITE EXCLUSIVE

What kind of word is "kinkajou"? Find out in Did You Know?—plus catch Sights & Sounds with photographer Mattias Klum: nationalgeographic.com/ngm/0310.






"I TRACK BY NIGHT AND TRAP BY DAY," SAYS KAYS, BAITING A CAGE WITH BANANAS A HUNDRED FEET UP IN A FIG TREE. LOWERED BY ROPE TO THE GROUND, TRAPPED KINKS ARE TRANQUILIZED AND EXAMINED, THEN RELEASED ONLY WHEN FULLY ALERT.





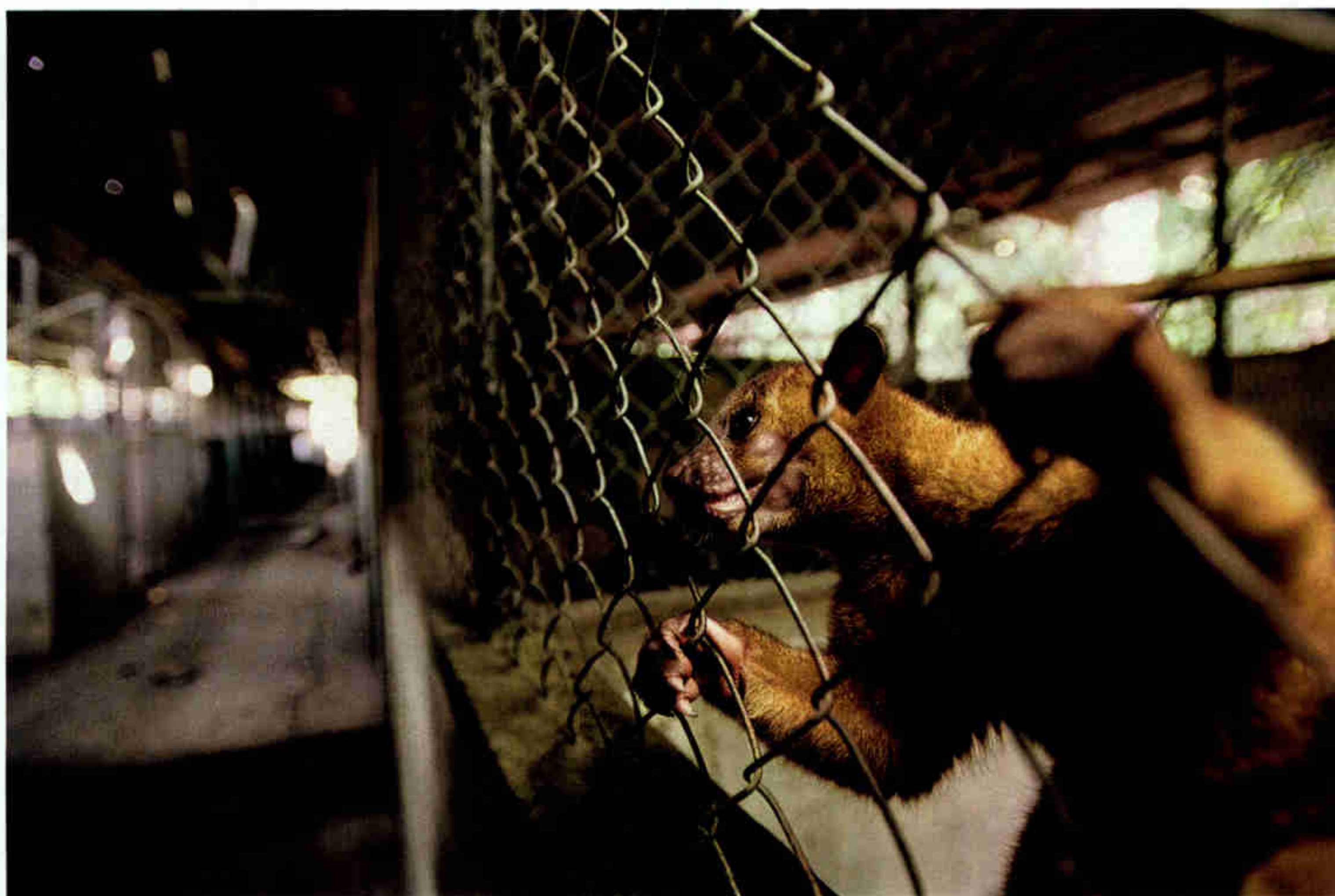
A close-up photograph of a sloth's head and front paws resting on a dark, textured tree branch. The sloth's fur is a mix of brown and tan. Above the sloth, several large, vibrant green leaves with prominent veins are visible. The background is dark and out of focus.

NUZZLING FOR ATTENTION,
A JUVENILE MAY TRY A MOTHER'S PATIENCE.
"I OFTEN SEE MOM GET KIND OF FED UP,"
SAYS KAYS. KINKS USUALLY BEAR ONE PUP
EVERY YEAR OR TWO, NURSING IT FOR
AS LONG AS FOUR MONTHS.



| GROUNDED |

A SMOOCH FROM MARRON TICKLES A VISITOR
AT PANAMA CITY'S PARQUE NATURAL METROPOLITANO. GIVEN UP
BY A PET OWNER, MARRON RELISHES THE TOUCH OF CHILDREN
AND IS KEPT OUTSIDE HIS PARK CAGE (BELOW) AS MUCH AS POSSIBLE.
AS FOR KINKS AS PETS, KAYS CAUTIONS: "UP ALL NIGHT,
CAN'T BE HOUSEBROKEN."





"KINKAJOUS HAVE A NETWORK OF ROADS
INVISIBLE TO US BUT VERY CLEAR TO THEM,"
SAYS KLUM. "WE CATCH GLIMPSES,"
ADDS KAYS, "BUT THERE ARE STILL PLENTY
OF QUESTIONS." □





BEYOND THE LOOTING

WHAT'S NEXT FOR IRAQ'S TREASURES?

Precious gold and prized sculptures have been returned to Iraq's museums. But a loss even more devastating is taking place in ancient sites across the country. A National Geographic team investigates.

Organized looters plunder the ancient mounds at Isin, a city-state in southern Iraq that dates back to 1900 B.C.





Fabled land between two rivers, Mesopotamia is rich with artifacts, such as this ancient figurine (above). For centuries farmers, priests, and generals wove a complex, often bloody history in the region that is now Iraq—leaving traces sought by archaeologists as well as thieves like this one (below) at Isin.



BY ANDREW LAWLER
PHOTOGRAPHS BY STEVE McCURRY
AND RANDY OLSON

“Don’t shoot! We’re Americans!” Henry Wright shouts as he thrusts his head out the window. It’s dark, but dead center in our headlights is a jumpy young U.S. marine aiming his weapon at the windshield of our white SUV. This team of archaeologists and journalists who’ve come to

assess the damage to Iraq’s ancient sites had been warned of armed looters, not friendly fire. But cruising the backstreets of the battered town of Nasiriyah after dark in search of the local museum, we’ve run into a Marine roadblock. The museum, we discover, is now a military barracks.

Grim tales of mass looting have brought our expedition, sponsored last May by the National Geographic Society and led by Henry Wright, a professor at the University of Michigan’s Museum of Anthropology, to this dusty place where humanity’s first great cities once dominated the vast Mesopotamian plain. While media attention has focused on the loss—and recovery—of artifacts in Baghdad’s Iraq Museum, we’re investigating reports that poverty-stricken villagers and organized bandits are ransacking ancient mounds across the country, feeding the foreign appetite for antiquities. The five archaeologists on the team are anxious to see what’s happened to the sites in the decade since the 1991 gulf war prompted U.S. restrictions that kept Americans from digging in Iraq.

Our expedition finds both tragedy and reason for hope. Some sites resemble moonscapes, cratered with freshly dug holes and trenches where looters may have

ripped out more artifacts in a few weeks than archaeologists have excavated in decades. Others shimmer intact and silent in the desert heat. While half the expedition team travels through southern Iraq, the other half probes the situation in the north, where the damage is less dramatic but still a cause for serious concern.

In Nasiriyah we are in luck. Marine Maj. Glenn Sadowski is extremely helpful. He has organized an armed escort to take Iraqi archaeologist Abdul Amir Hamdany to survey the local sites, and he invites us along. The two men are an unlikely duo. Sadowski is a strapping reservist whose platoon lost seven men during the 1991 gulf war. Hamdany is a soft-spoken scientist who’s been evicted from his own museum, where off-duty marines are pumping iron to heavy metal music. Neither speaks the other’s language. But Hamdany returns day after day to stand on the burning sidewalk and ask Sadowski’s help. “In the bazaars they are selling antiquities,” he says. “We have to do something.”

The aim of the National Geographic survey is to put a spotlight on the crisis. Without U.S. troops or paid Iraqi guards providing round-the-clock protection, many sites will remain vulnerable. Keeping Iraq’s treasures safe will require a level of security that at this point is elusive at best. But Hamdany knows that careful assessment of site damage is a critical first step. “You can tell he has a passion for this,” Major Sadowski says, after agreeing to supply the escort. “It’s the least I could do.” On such slender threads of trust and respect hangs the future of Mesopotamia’s past.





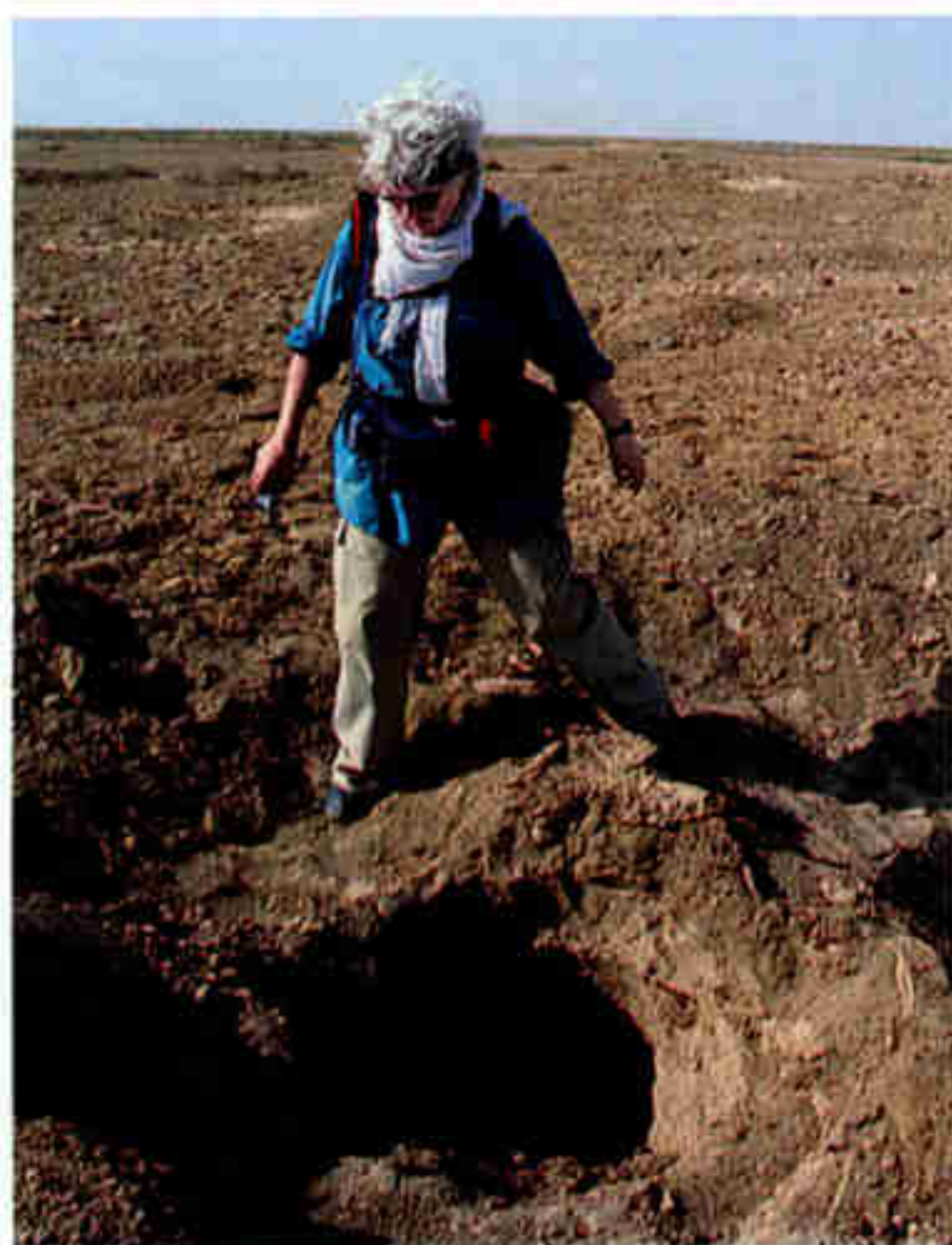
ELIZABETH STONE, ARCHAEOLOGIST

What fuels this destruction are those in the West who buy illegally exported

antiquities—it's just like the drug trade. Why does the looting matter? Because each illicit hole is a small rent in the fabric of history. The aim of history is to humanize the past, but each object ripped from its context loses its connection with its makers and users, loses its voice, and becomes mute, a mere pretty thing. And in this part of the world, many of the objects

indeed speak. Mesopotamia's written tradition survived the vagaries of time because it was inscribed on sturdy clay tablets. Private letters, contracts, works of literature, and records of institutions can be found in the buildings where they were created. But the tablets in the antiquities market? They can't tell a story. Often the less salable bits and pieces are ignored or destroyed. Some of the key texts archaeologists have preserved, such as the Sumerian version of the biblical flood story, were painstakingly assembled from fragments. Today's looting means we will never know what was lost. For instance, we'll never know anything about the cemetery at Dahaila. We were stunned when we reached this important area where tens of thousands of people lived 3,700 years ago and that now lies deep in the desert. Looters clearly found the place productive—there were holes everywhere. I'd always wanted to excavate here. Since this was a short-lived city, its tablets and artifacts could have provided insights into the old Babylonian period. To halt this destruction, nations need tougher laws to discourage collectors, tighter border controls, and awareness among politicians and the public that our shared human heritage is nonrenewable."

Elizabeth Stone peers into a looters' hole at Dahaila, last occupied 3,700 years ago.



A NEW MISSION Weapons drawn, U.S. marines (right) probe the Sumerian city of Girsu for thieves. Crude new holes, fresh footprints, and tire tracks were evidence that the marines and our expedition had interrupted recent looting. Some antiquities dealers and collectors will pay \$10,000 or more for a carved cylinder seal or cuneiform tablet stolen from sites like this one. But the typical villager who finds

BABYLON



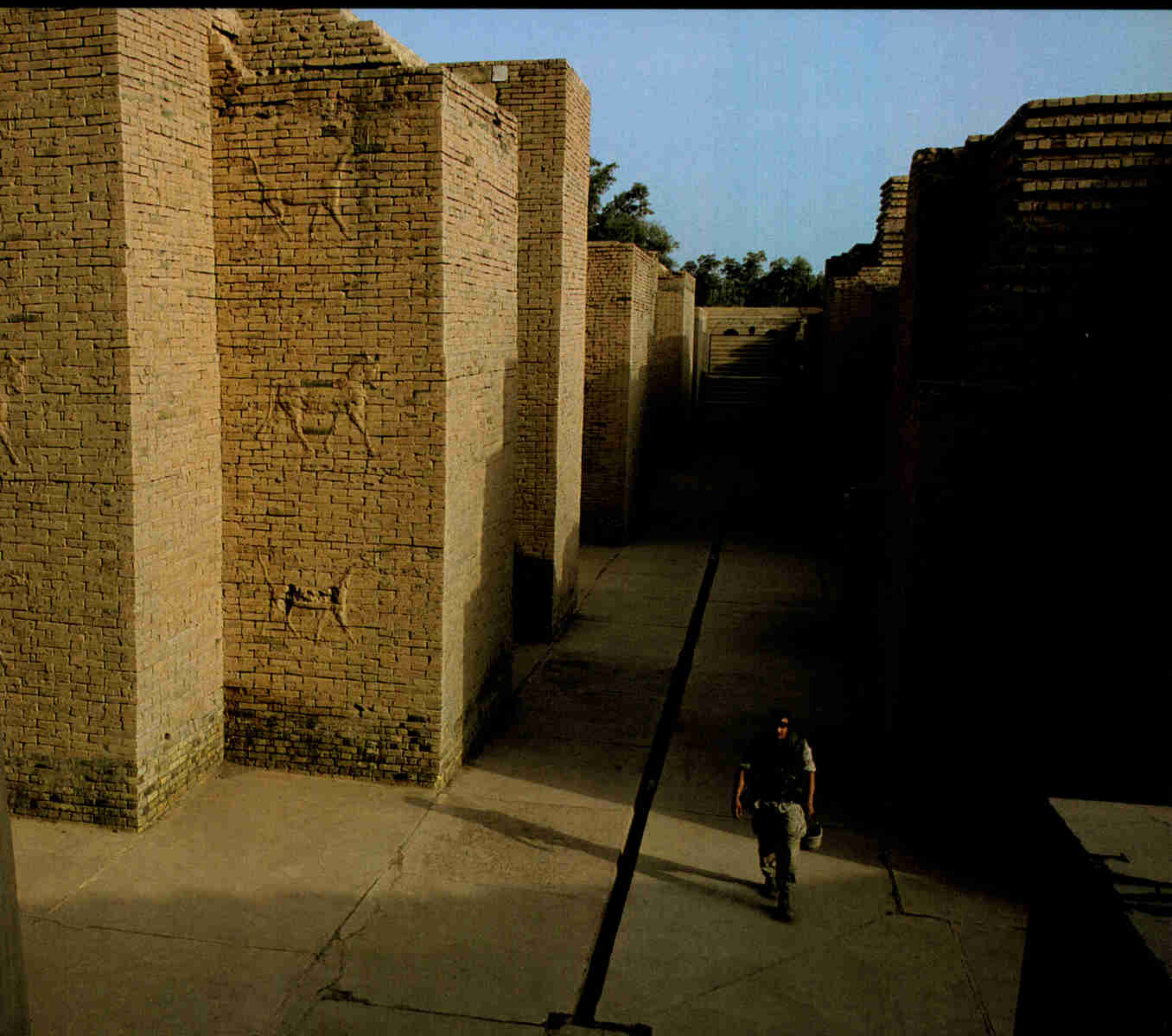
such an item receives only a tiny fraction of that amount.

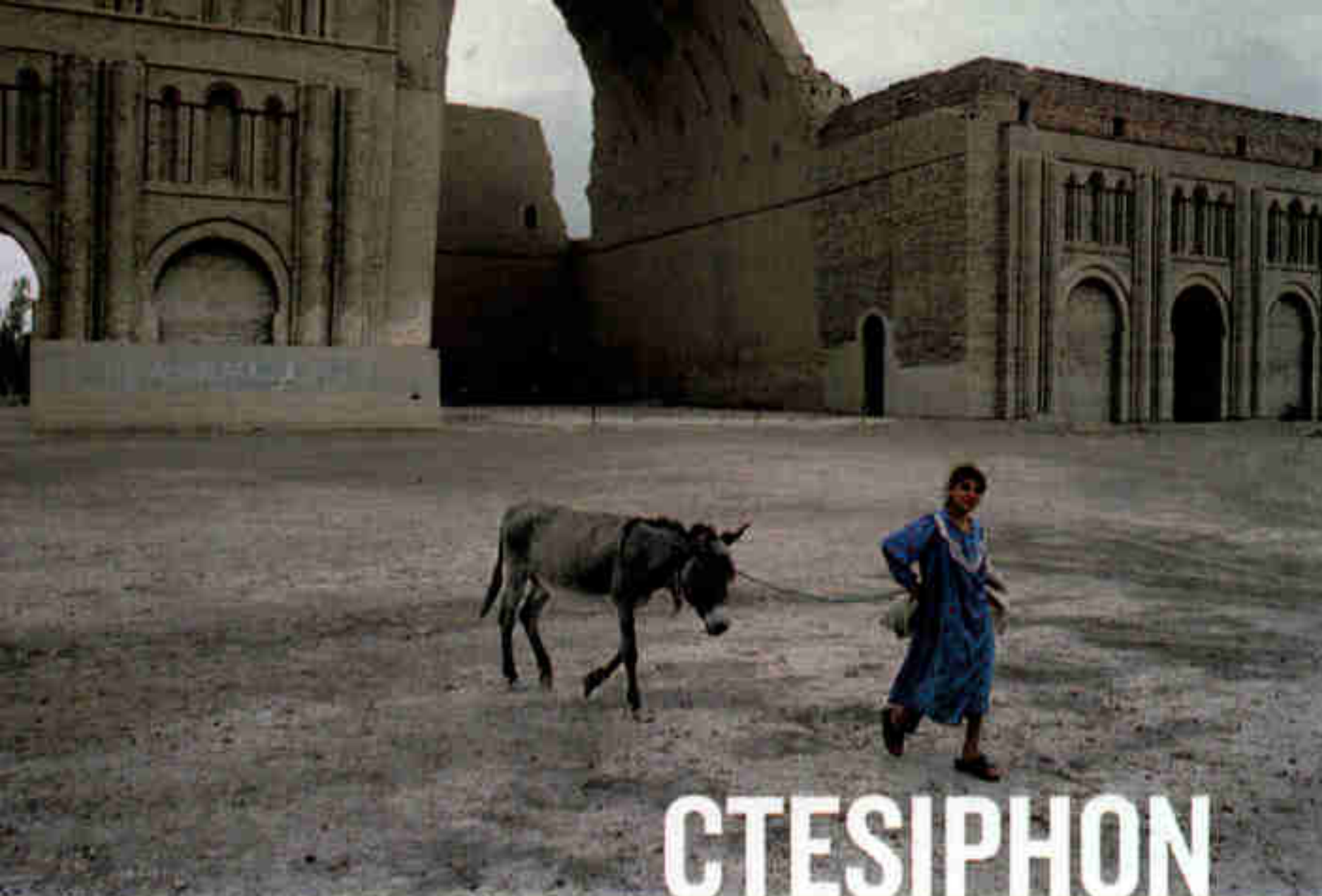
A lone marine walks down a street in Babylon (below), the city where Nebuchadnezzar II once ruled. Saddam Hussein reconstructed it as a tourist spot. Before U.S. forces arrived, angry mobs trashed the nearby museum and burned the gift shop while an elderly caretaker unsuccessfully tried to hold them off with a sickle.



STEVE MCCURRY (ALL)

GIRSU





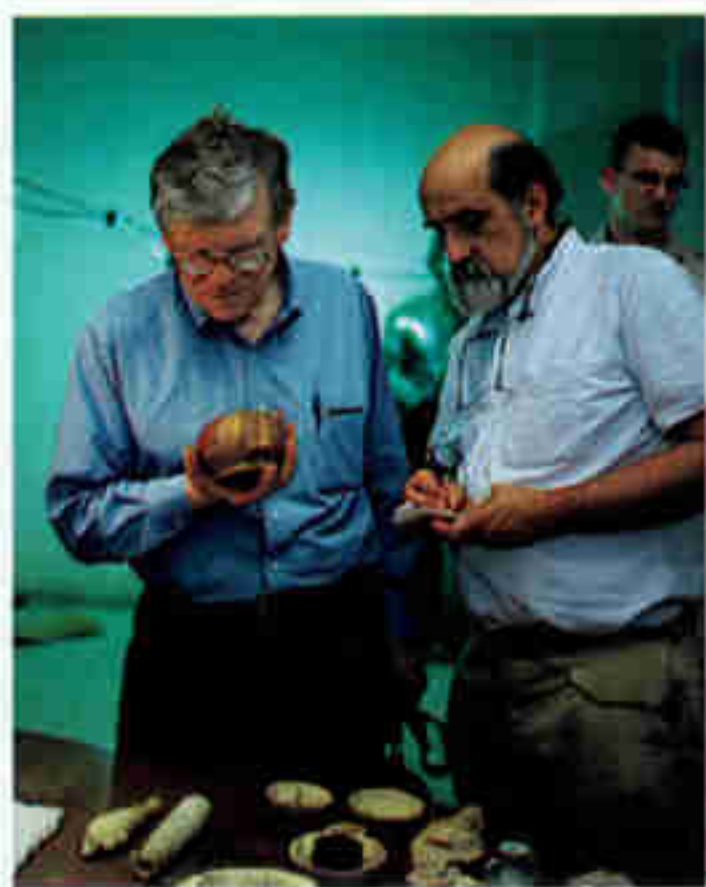
CTESIPHON



MCGUIRE GIBSON, ARCHAEOLOGIST

When the Marine helicopter swooped down over the ancient

city of Isin, we saw two or three hundred looters destroying the site. They actually smiled and waved at us—they had no idea we had come to halt their illegal dig. We told them what they were doing was forbidden, and the marines with us fired shots over their heads to hasten their exit. We did the same at Umma, but as we were leaving, we could see the looters coming back to work. Our survey of remote sites in southern Iraq painted a terrible picture. Iraq used to have strict regulations and a fierce pride in



McGuire Gibson, left, and Henry Wright view returned artifacts at the Iraq Museum.

protecting its cultural heritage. Looting wasn't a problem until the mid-1990s, when poverty brought on by UN sanctions pushed local people into digging for antiquities to survive. Fortunately our Iraqi colleagues began legal excavations at places like Umma, and that dis-

couraged illicit looting. But this war has created an unprecedented crisis. Iraq is probably losing more of its antiquities from the ongoing pillaging of these sites than were taken from its museums in the days immediately following the war. Clearly, this devastation must be stopped, and an occasional visit by a helicopter is not going to save these sites."

McGuire Gibson is a professor at the University of Chicago's Oriental Institute.

NASIRIYAH



STEVE McCURRY (TOP AND ABOVE); RANDY OLSON (LEFT)

MUSEUM BARRACKS A young marine (below) relaxes in the cool of the Nasiriyah Museum, which exhibits replicas of ancient statues. During the 1991 gulf war the museum director hid the real artifacts from rampaging mobs; this time they were sent to Baghdad beforehand for safekeeping. The angry husband of today's curator complained to U.S. authorities about their occupation of the museum, which also serves as the family's home. One private replied: "If the guy can find a flight back home for a thousand of us, he can have his house back." Ctesiphon (left) was home to Sasanian rulers in the third to sixth centuries A.D. With no guard and no fence, graffiti, bricks, and litter now mar the park.





HENRY WRIGHT, ARCHAEOLOGIST

Doing archaeology in Iraq takes much more than excavating and analyzing

artifacts. That's one thing my wife and I learned when we were newlyweds in 1966 at Ur, the ancient Sumerian city that flourished 4,000 years ago: You have to win over the local leaders,



Henry Wright, left, and local leaders meet at the tent of Sheikh Ali near Ur.

since they provide the guards, the workers, the local knowledge. Right now, many of the site guards have been run off at gunpoint by looters. The ones who've stayed haven't been paid in months, and many are forbidden by the U.S. soldiers from carrying guns. Reestablishing local control over the sites is essential. After all, Baghdad is far away—then and now. Sir Leonard Woolley, who famously excavated the Royal Tombs of Ur in the 1920s, found out the importance of working with the local leader when his camp was attacked and robbed. Sheikh Manshet of the al-Ghizzi tribe took responsibility for the robbers, turned them over to the authorities, and assured Woolley there would be no more trouble. So when I arrived at Ur in 1966 to study land use and settlement patterns in the region, my first stop was at the tent of Manshet's son, Sheikh Muhammad. During my fieldwork he asked me for a copy of the book he knew I would one day write about Ur. Muhammad has since died, but when I returned this spring I was able to present my last copy to *his* son, Sheikh Ali. I explained that I had come to fulfill a decades-old promise. My Arabic had gotten rusty. But the glasses of tea and the warmth of these people remained unchanged. If all goes well, a tribal leader's promise to protect an archaeological site will once again be a valuable tool to preserve Iraq's past."

Henry Wright is a professor at the University of Michigan's Museum of Anthropology.

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LASTING LEGACIES The ninth-century A.D. spiral minaret of Samarra (right) and the 4,000-year-old ziggurat of Ur (below) reach into the pale blue Mesopotamian sky. Many of Iraq's sites have been reduced to rubble because mud brick, the building material of choice here, doesn't last long. Thanks to baked brick and renovations, these two have managed to survive.

A spray of holes on one side of the Ur ziggurat, built around 2100 B.C., testifies to the ravages of modern warfare. Now an enormous U.S. military base encircles the site, providing protection from looters but also raising worries about archaeological damage.

Situated on the Tigris, Samarra's vertigo-inducing minaret gives a hint of the grandeur of this elaborate early Islamic capital, which fell into ruin when the caliphs abandoned it for Baghdad in A.D. 892.

STEVE McCURRY (LEFT, RIGHT, FAR RIGHT); MARK ALTAWHEEL (INSET)



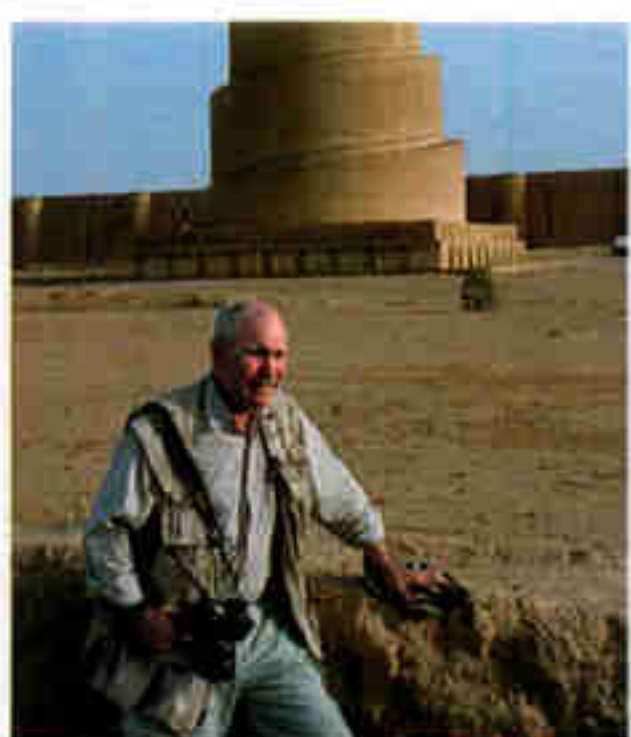
STEVE McCURRY, PHOTOGRAPHER

I'd covered Iraq during Saddam's rule, even got arrested with the

director of antiquities once. This time the sense of danger was palpable. It was dusk, and we were visit-

ing the ancient arch of Ctesiphon south of Baghdad. An open-air gun market was in full swing nearby. Children with rifles roamed the area, which was full of dust and trash. Near the arch is a building with a vast mural of the seventh-century battle of Kaddisiyeh, a victory of Arab armies over the Persians. I'd photographed the painting in 1985, but now the building was dark and totally looted.

It wasn't just that the glass was broken or that the fixtures were ripped out of the wall. You could feel some kind of mob rage. It was spooky."



Steve McCurry by
Samarra's minaret.

SAMARRA

UR





NINEVEH



RANDY OLSON, PHOTOGRAPHER

It was strange being sent to a war zone to photograph dusty hills and

artifacts—with a team that didn't always seem fully cognizant of the danger. At one point in downtown Baghdad I got out of our car to take pictures of a building on fire. The car left, and then the shooting started. People came running toward us yelling and screaming, and I realized my bulletproof vest was still in the car that had just left. I ended up back-pedaling, elbow to elbow with other photographers as they pulled a half-dead Iraqi out of the burning building. These images had little chance of being published in a story about archaeology, but it was

impossible to ignore the human drama of this place. When we reached Nimrud, an ancient Assyrian capital on the Tigris, it was being guarded by the 101st Airborne. Before they'd arrived, looters had stolen two pieces of



Randy Olson in Baghdad with the communications building burning behind him.

carved slabs. One of the soldiers, a kid really, who was armed to the teeth, told me war stories as dusk descended on his first night at Nimrud. He confided that he was afraid to go to sleep because of the 'ancient ghosts.' When I got back home, I got a call from the people who'd sold me the bulletproof vest. They wanted to know how it had worked."



RUINED RUINS Once the center of Assyrian power, Nineveh boasted gardens, temples, and a royal library surrounded by massive walls (left). Now the site is being encroached upon by the modern city of Mosul. Within Nineveh's walls, King Sennacherib's palace lies exposed to sun, rain, and looters (below). The protective metal roof has been stolen, and many of the carved slabs showing the king's campaigns—designed to intimidate visiting dignitaries—have been severely damaged from neglect and vandalism. Assyrian carvings sell for millions of dollars apiece; one stolen from Sennacherib's palace surfaced in London during the 1990s but was eventually returned to Iraq after a long court battle.





TONY WILKINSON, ARCHAEOLOGIST

American soldiers nearly arrested us at Nineveh. We had arrived in the morning

at the vast site—the nerve center of the Assyrian Empire in the seventh and eighth centuries B.C.—and wandered undisturbed. Much of the damage we saw was due to the general decay that had taken place over the decade between the two wars, when sanctions made conservation materials hard to come by. When we returned that afternoon, a half



Tony Wilkinson gives an impromptu history lesson to soldiers guarding sites in Nineveh.

dozen U.S. soldiers intercepted our SUV and demanded to know who we were. It turned out for the

best. We were able to introduce the soldiers to the Iraqi guard responsible for keeping an eye on the site for the State Board of Antiquities. They had never formally met. The guard spoke no English and was scared by the heavily armed soldiers. The U.S. officer, who spoke no Arabic, said he had seen the man around, but since he had no gun, he hadn't considered him a threat. Unarmed, he wasn't a threat to looters either. This was typical of the disconnect we saw between the U.S. troops and the Iraqi people. The soldiers don't know the land or the language and are navigating blind. As an archaeologist who always has to make strong contact with the locals, I found this strange. If the U.S. wants to protect these sites—and to be seen as liberators rather than occupiers—that human contact will be critical."

Tony Wilkinson is a research associate at the University of Chicago's Oriental Institute.

FACE-OFF The circular city of Hatra (right), which combines Roman, Persian, and Arabic influences, was an important religious center around the time of Christ. Part of a carved figure that decorated one of its many arches was shot off and apparently stolen during the recent upheavals. But thanks to the protection of local tribes and round-the-clock U.S. military presence, the ruins suffered

NIMRUD



only minor damage.

Winged bulls and lions with human faces stand guard at the gates of Nimrud (below), but they didn't protect the site from looters seeking more of the palace's riches. Nimrud's gold was unearthed in the tombs of Assyrian queens by Iraqi archaeologists between 1988 and 1990. American soldiers now patrol the site, where more artifacts may still await discovery.



HATRA

RANDY OLSON (ALL)



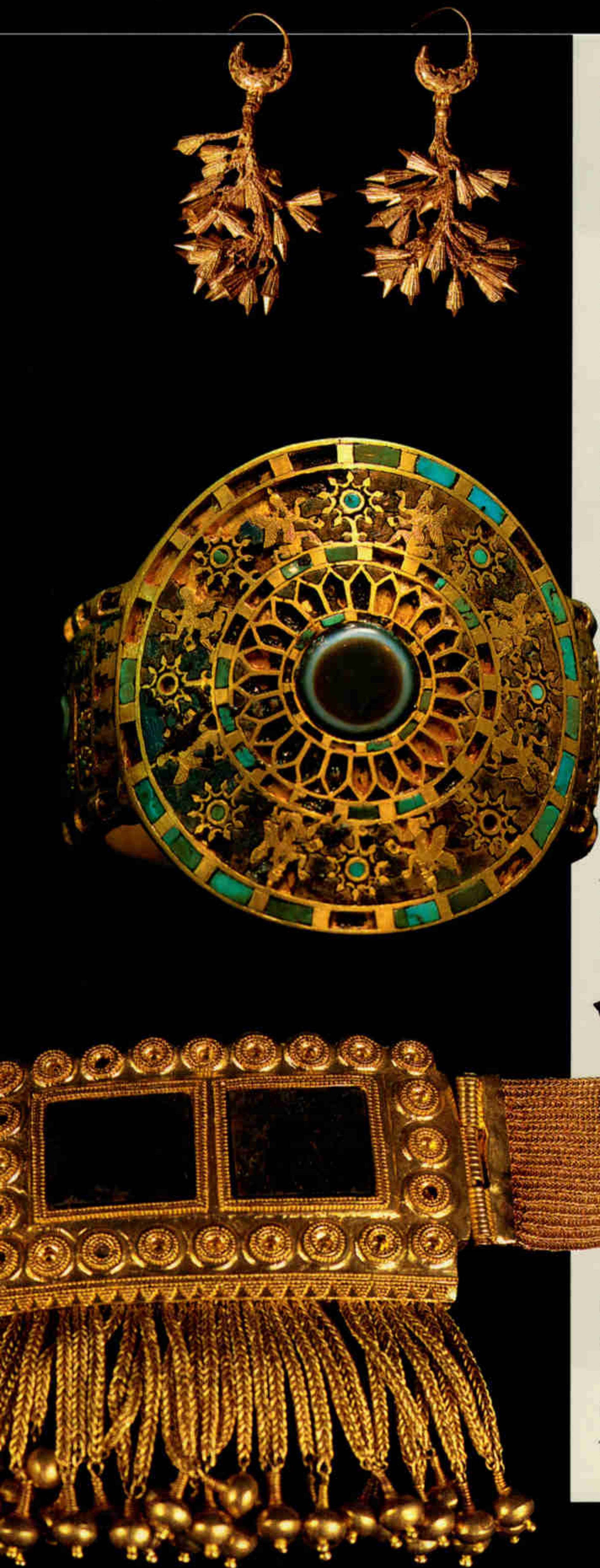


GOLD OF NIMRUD

Forgotten for nearly three millennia and then hidden for more than a decade, one of the greatest treasures of the ancient world has finally emerged.

TWICE BURIED The resplendent gold jewelry from four tombs at ancient Nimrud once graced the royal consorts of Assyria's rulers in the eighth and ninth centuries B.C. Iraqi archaeologists discovered the treasure by happenstance. It was on display for just a few months before the 1991 gulf war, when it was packed away for protection in a vault beneath Baghdad's Central Bank. Though the bank was bombed, burned, and flooded during the recent war, the Nimrud artifacts emerged in June largely unscathed. Art historians say the collection of crowns, earrings, and bracelets is among the finest ancient gold ever found.





THE ARCHAEOLOGIST WHO STAYED BEHIND

Tanks rumbling down the streets of Baghdad woke up Iraqi

archaeologist Donny George before dawn on April 8. U.S. forces were entering the Iraqi capital, and George and a small group of his colleagues for weeks had been taking shifts sleeping in the Iraq Museum to protect it from looting. By late morning pro-Saddam militia were climbing over the museum walls while American helicopter gunships hovered ominously above. His boss decided it was time to abandon the complex. Because of fighting and roadblocks, the staff couldn't return for three days, and George heard about the trashing of the museum from BBC Radio.

"I couldn't sleep all night," he recalls. When he did get back, he was greeted by ransacked offices, an unknown number of artifacts smashed or looted, and hordes of reporters. Within days the researcher emerged as a spokesperson for the museum, thanks to his perfect English, unflappable manner, and obvious passion for the artifacts. While many Iraqi archaeologists—and most of his family—emigrated long ago, George stayed behind during the grim decade of the 1990s. Now he faces the formidable task of finding the money, equipment, and training necessary to get Iraqi archaeology back on its feet again.



Donny George stands amid the devastation of the Assyrian Gallery in Baghdad's Iraq Museum.



TELL BILLA

“ MARK ALTAWHEEL, ARCHAEOLOGIST

We found unexploded tank shells all over Tell Billa, a site across

the Tigris River from Mosul. Like several places in northern Iraq, it was damaged from being used as an Iraqi military camp. The army had been preparing for an expected coalition attack from the north, which never came. Local villagers who found the live explosives and told us about them were terrified but didn't know what to do. Fortunately we had global positioning system coordinates, GIS databases, and maps—critical tools for modern archaeologists—which allowed us to report the location of the shells to the



Mark Altaweel, right, tells a U.S. Army sergeant about the explosives near Mosul.

U.S. military at its headquarters in Saddam's former palace in Mosul. We also told them about unexploded ordnance near Khorsabad, an ancient Assyrian capital not far from Mosul. We hoped they would take care of it, but their to-do list is long. When we visited Tell Billa again,

we saw children playing with the explosives (top). Of course we realize that protecting archaeological sites is only one of the challenges for the future of Iraq. My family comes from Baghdad, and I am saddened to see what more than a decade of war, social isolation, and economic sanctions have done to this country's people.” □

Mark Altaweel is a Ph.D. candidate at the University of Chicago's Oriental Institute.

NIMRUD

LOOKING AHEAD Though reviled in the Bible as cruel and despotic rulers, Assyrian kings created the first truly international empire where trade, religion, and artistic ideas flowed freely. Archaeologists are hoping that new excavations at places like Nimrud (right) could begin as early as next year, providing them with a fresh understanding of an ancient culture that preceded the Persian, Greek, and Roman empires. But as Iraq's future remains uncertain, so does the future of archaeology in the region. For more of Mesopotamia's rich history to emerge tomorrow, thousands of important ancient sites must be protected from looters today.

RANDY OLSON (ALL)

WEBSITE EXCLUSIVE

- Listen to archaeologist Henry Wright talk about what Iraq's ancient sites mean to the rest of the world.
- Hear photographers Steve McCurry and Randy Olson describe the gritty realities of working in a war zone.
- Get an update on the looting of Iraq's antiquities. nationalgeographic.com/ngm/0310





NATIONAL
GEOGRAPHIC
RESEARCH AND
EXPLORATION

By Cheryl Knott
Photographs by Tim Laman



GRANTEE

Cheryl Knott
Anthropologist
Gunung Palung
National Park, Indonesia

"At the current rate of habitat destruction, orangutans could be extinct in the wild in 10 to 20 years. We must stop this trend—the alternative is unthinkable."

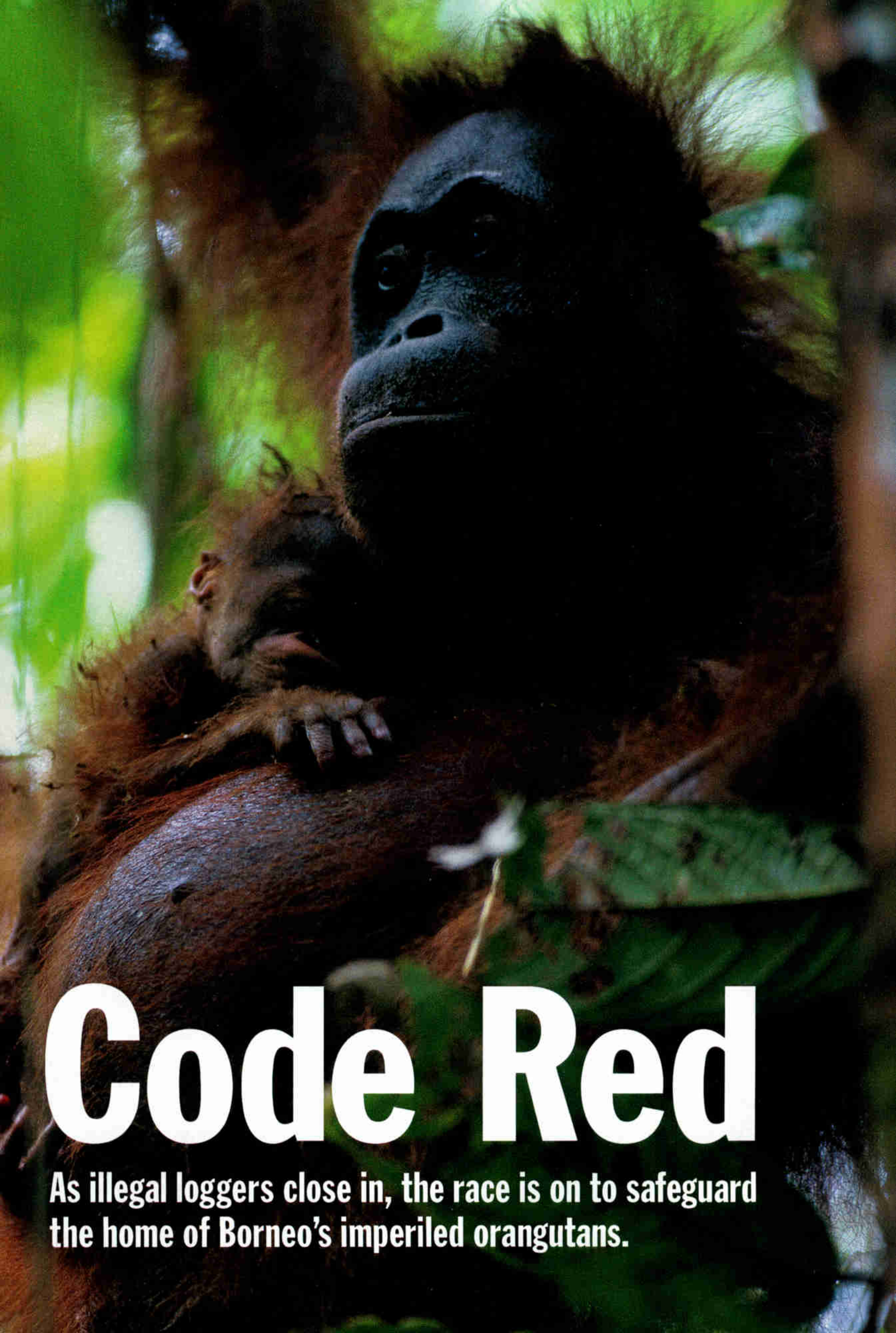
"**M**arissa had a baby!" The good news arrived with my field assistant Rhanda as he dashed into our research camp in Borneo's Gunung Palung National Park. For three days we hadn't seen Marissa, one of about 50 orangutans I've studied in the wild since 1994. Rhanda found Marissa eating fruit from a *Gnetum* vine with the newborn female clinging to her mother's side. Orangutans bear young only about once every eight years (thought to be the longest span of any mammal), so there was much to celebrate.

That was in 1998, shortly after I first reported on my research for NATIONAL GEOGRAPHIC. In several successive trips to Borneo, I've been relieved to find that Martina (as we named the new arrival) and the other orangutans at our site are doing well, despite the ever expanding reach of illegal logging.

But the threat of deforestation cannot be ignored. While our work continues to reveal new secrets about these apes, we're redoubling our efforts to protect their fragile habitat.

Sporting dreadlocks from her birth three weeks earlier, Martina grips mother Marissa's still enlarged belly. Marissa (featured in the August 1998 NATIONAL GEOGRAPHIC) is part of a population of orangutans studied in Borneo. Some of our closest kin, orangutans are also some of the most endangered—victims of deforestation and hunting, and unable to bounce back easily because of their own slow rate of reproduction.





Code Red

As illegal loggers close in, the race is on to safeguard the home of Borneo's imperiled orangutans.



THE PROJECT

STUDY SITE: GUNUNG
PALUNG NATIONAL PARK

PARK'S ORANGUTAN POPULATION:
ABOUT 2,500

WORLDWIDE POPULATION: 15,000 –
24,000 IN THE WILD

CURRENT RESEARCH: STUDYING
ORANGUTANS' INDIVIDUAL RANGING
PATTERNS, JUVENILE DEVELOPMENT,
AND MALE AND FEMALE MATING
STRATEGIES AND REPRODUCTION

I and my team of field assistants, managers, and students have spent more than 50,000 hours over the past decade observing orangutan behavior and documenting the apes' physiology. Our work investigates how the boom-and-bust cycle of rain forest fruits affects birth intervals and the length of juvenile dependency.

Recently we participated in a joint effort with other scientists to look at orangutan "culture"—customs passed from one generation to the next and often unique to particular populations. For example, Martina will grow

up threatening strangers by making kiss-squeaking sounds into a handful of leaves—a behavior seen regularly only at our site. Some 500 miles west of Borneo in Sumatra, orangutans use sticks to pry calorie-rich seeds from prickly, hard-to-eat *Neesia* fruits, a clever trick that youngsters pick up from the adults—and one that Borneo's apes have not devised.

Another significant find at our site was that fully developed adult male orangutans, known as prime males, stay in top physical condition only for a few years. Following females and

fighting with other males wears them down, diminishing masculine traits such as full cheek pads and large throat pouches and curbing certain behaviors like mating and long-calling—a loud bellowing made to announce their presence. As these features disappear, males become what I call past prime, a condition that usually signals

Prime male Jarl Manis was in top condition in April 1997 when NATIONAL GEOGRAPHIC first took his photo (inset, August 1998 issue). But 19 months later (below) he was a shadow of his former self. Shriveled cheek pads illustrate the difficulty of maintaining peak condition. Marissa's baby, Martina (right, at three years old), was likely fathered by Jarl during his prime.









Like Marissa, I now have a young child, Russell. In 2001, at age one, he first trailed his hand in the cool water of Borneo's Gunung Palung (left). Fieldwork is difficult when combining parenthood and research, but it was something my husband, Tim Laman, and I were determined to do. The open-air camp doubled as a nursery where Rima, an Indonesian student (below), helped as we juggled work and child care during this brief two-week trip. On our most recent visit earlier this year, we investigated large areas of felled trees within our study site. It's shocking to see what has been lost to illegal logging since my project began. No doubt, orangutans are in trouble. Russell's innocent enthusiasm only strengthens our resolve to save them.



the end of their reproductive life cycles.

Many orangutan males delay developing prime traits for several years, although they're still capable of fathering offspring. I believe the environment may be partly responsible. Natural plant cycles cause severe fluctuations in fruit production. During shortages orangutans consume fewer calories—and in females

As go the trees, so go the orangutans. Deep in Gunung Palung, illegal logging has transformed another forest giant into planks (left). Rain forests might recover from a small amount of selective logging, and some orangutans could endure such incursions. But the ongoing destruction surely threatens their long-term survival.

this translates to lower fertility. In response males may wait to attain their prime condition until a future time when food is more abundant and they have the best chance of reproducing.

Sadly that future looks bleak for orangutans. By some estimates more than 80 percent of all orangutan habitat has been destroyed. Deforestation in Indonesia is escalating; since 1996 legal and illegal logging has consumed about five million acres of forest each year. Recent political upheaval has brought economic turmoil and lawlessness—hardly a recipe for successful conservation.

Populated with about 2,500 orangutans, Gunung Palung is one of their last strongholds. Overall, however, orangutan

numbers are falling: The 15,000 to 24,000 remaining apes (endemic to Borneo and Sumatra) could vanish within the next 20 years.

Meanwhile, Marissa, Martina, and the others here have much to teach us about how to ensure their survival. And through our educational outreach programs and awareness campaigns around the park, we are drawing public attention to the orangutans' plight and helping to make a difference. It would be tragic to let these great apes slip away. □

WEBSITE EXCLUSIVE

Want to learn more about orangutans? Post a question to anthropologist Cheryl Knott, then read her weekly replies at nationalgeographic.com/ngm/0310.

WATERY GRAVES OF THE

A SOURCE OF LIFE for the ancient Maya of the Yucatán lay in an underworld of cenotes—pools and cave rivers—many created after the



impact of a meteorite 65 million years ago. Now, newly discovered skeletons yield evidence of sacred funerary rites and human sacrifice.

By PRIIT J. VESILIND

Photographs by
WES SKILES



Limestone caps a cenote pool in the northern Yucatán. Mexican underwater archaeologists prepare to dive from a raft to examine artifacts and debris, while a member of a U.S. documentary team, seated in midair, descends into the cenote through a 70-foot well shaft. This key site yielded evidence of ritualized death among rural Maya.



THEY FORCED THEMSELVES
straight down into the cave,
like swimming into a fire hose.



Seeking a cenote passage, biologist Tom Morris (right) burrows through a tight tunnel beneath the Gulf of Mexico seafloor, laying a line to guide himself out. With room to roam, cave diver Luis Fernando Martínez (left) notes a modern cow skull on what looks like an underwater desert. Though now submerged, this part of the cenote went bone-dry when water levels fell during ice ages.



Mission to the underworld complete, Arturo González rose up the narrow well shaft dangling in a metal chair, his black wet suit dripping, the rope inching through the squeaking pulley above his head. González, a Mexican underwater archaeologist, had just dived to the bottom of a hidden sinkhole that lies 70 feet below an old stone well in the thorny jungle of the Yucatán. In his hands he held a lidded plastic tub.

Encircled by the strong arms and expectant faces of his team when he reached the surface, González sought out Carmen Rojas, the young archaeologist who was co-director of his research project, and handed her the tub. "Don't drop it," said González, a boyish 37-year-old with a stout heart and a perpetually quizzical look on his face. Rojas ignored the comment and carried the tub to the open-sided conservation lab behind the abandoned hacienda, where Alejandro Terrazas, a physical anthropologist, waited impatiently.

They removed the lid and looked inside. Terrazas slowly picked up the skull and cradled it in his hands. He smiled. It was hundreds of years old and darkened to the color of burled oak, but he could envision how flesh and skin had filled out the young man's Maya face, and how his dark eyes might have stared, if not smiled, back at him.

The man had been about 25, with a forehead that slanted radically back from the eye sockets because boards had been clamped around his malleable cranium when he was an infant, for fashion. He had died violently; the skull was cut, as if someone had hacked it with a knife.

Terrazas peered closely at the cut marks. "That looks like defleshing," he said, the process of removing the muscles from the top of the victim's head down the face.

LIVE VICTIMS were thrown into the sacred cenote at Chichén Itzá on the premise that, as sacrifices to the gods, they would not die—though they were never seen again. I scanned the slick limestone walls, and my heart pounded, feeling their terror.



A gaping jaw evokes the pain of a Maya, perhaps a sacrificial victim, his darkened skull resting in the sand for hundreds of years. Knife marks on a similar find suggest that some victims were ritually mutilated. Cave diver Martínez (opposite) dangles in the well shaft that leads to the underwater grave.

Perhaps a human sacrifice. It was the first skull with signs of defleshing found in the clear depths of the 20 or so freshwater pools, or cenotes, explored in the past two years by the team from the Underwater Archaeology Area of Mexico's National Institute of Anthropology and History (INAH). Terrazas, himself a young man, with a thin black beard and the kind, moist eyes of an undertaker, betrayed no sense of horror. He gently placed the skull into its nest of wet cotton swaddling in the tub—a gesture you might see in a hospice.

"For the Maya the body was a vehicle for the journey to the afterlife," he said. "When a Maya priest made a sacrifice, he was operating in his special universe—helping that universe to continue. Good or bad aren't factors. I don't want to make moral determinations; I want to understand."

The INAH team was first led to the site by Wes Skiles, a bearded, broad-shouldered explorer and photographer from Florida, with crinkling eyes in which vulnerability and bravado tend to tussle. Skiles headed up a documentary team that joined the INAH scientists for a three-week expedition.

The expedition—part of an ongoing six-year survey to inventory all cenotes of scientific and cultural interest—was spurred by a sense of urgency. In recent years the cenotes and submerged caves that riddle the porous limestone of the Yucatán Peninsula, both Yucatán state and neighboring Quintana Roo, have been probed, explored, and sometimes damaged or looted by a growing number of sport divers. Along the coast known as the Maya Riviera, as many as 10,000 a year enter cenotes. The INAH archaeologists were eager to work with sport divers to document as many cenotes as possible before



they were compromised further.

“Every time a sport diver moves something, we lose a piece of the puzzle,” said Pilar Luna, director of underwater archaeology at INAH, who founded the discipline in Mexico almost three decades ago. Only in the past five years have archaeologists here acquired the necessary skills in cave diving to do a systematic survey of the cenotes. “We’re finally getting wet,” she said.

Camped among the ruins of a plantation in a thorny forest, the INAH team was hoping to learn more about the ancient Maya, who considered the cenotes sacred entrances to the underworld, and also about the fossil evidence and geology of the formations, which offer clues to the prehistory, and pre-Maya history, of the peninsula. Already the team had found evidence,

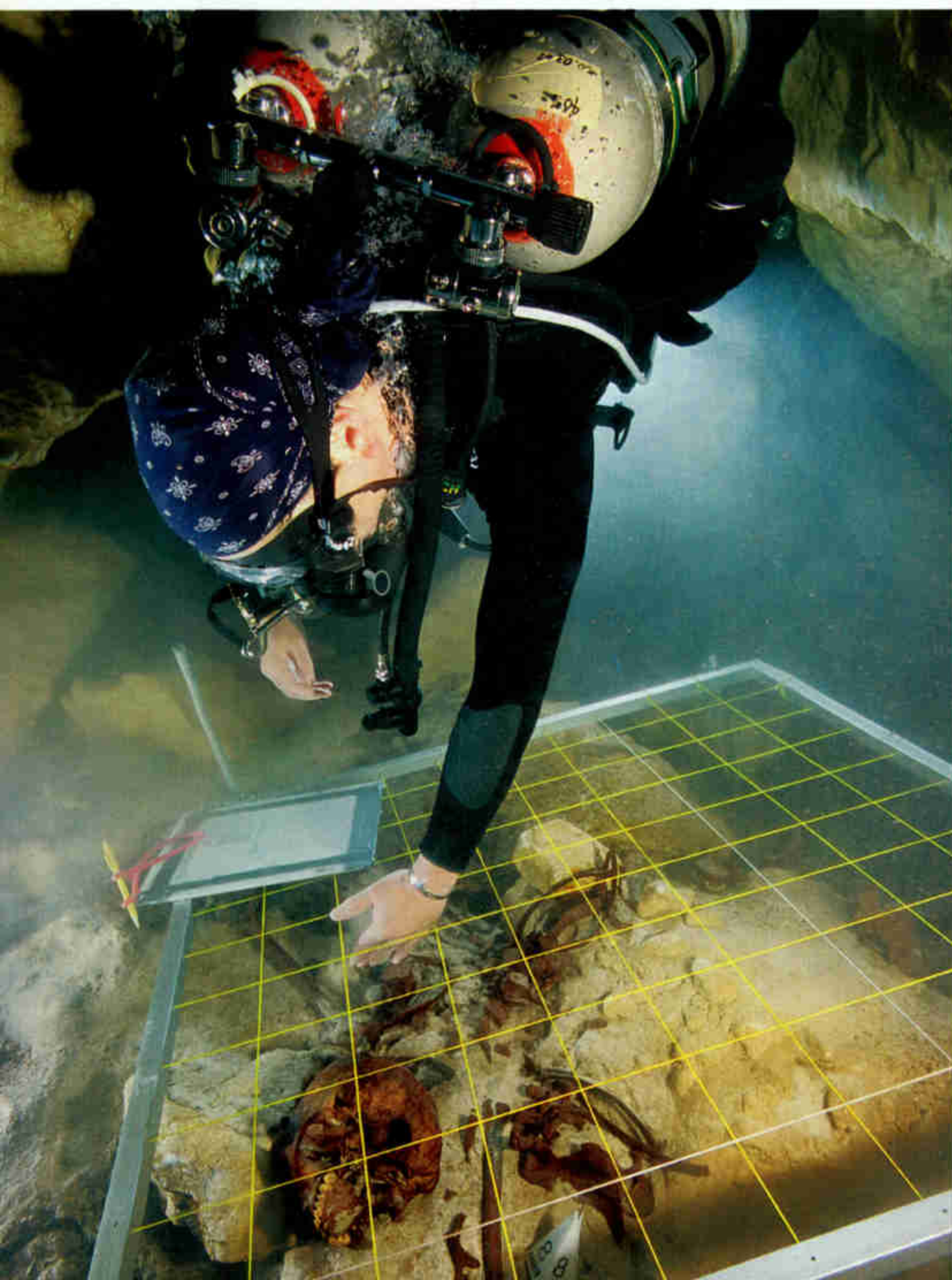
THE SKULL revealed telling knife marks. “At first I didn’t think we would find these kinds of sacrifices in rural cenotes, but now it seems I was wrong.” Terrazas grinned. “It’s wonderful to be wrong.”

in the form of carbon-dated ash, of a 10,200-year-old bonfire—the oldest recorded site of human occupation on the peninsula. The multidisciplinary team hoped to use its findings to produce scientific articles, a book, and a traveling exhibit. It also hoped to leave local communities better equipped to protect the sites.

The Maya civilization arose around 600 B.C. and dominated a vast area of what is today

Central America and Mexico from the time of Christ to A.D. 900, when many of its city-states collapsed amid political upheaval. It produced sophisticated architecture and art and developed math and astronomy that rivaled that of the Arab and Hindu worlds.

Many Maya still live in the northern Yucatán Peninsula, a tough, hot, prickly country—a slab



Underwater archaeologist Arturo González uses a portable grid to document scattered bones (left). He later brought up the first complete, undisturbed skeleton ever found in a cenote (right), which intrigues conservator Judy Logan, at left, and anthropologists Marta Benavente and Alejandro Terrazas. A remarkably preserved Maya pot (below) hints at daily life.



of limestone roughed over by tropical scrub forest. It has no rivers, no runoff. Rain percolates swiftly into the cenotes and flows to the sea unseen, through an underground labyrinth. It's like a still photograph, rather than a film: timeless, if not a bit stifling. Rivers have always provided a sense of motion, a narrative of beginnings and endings, travel and discovery. Without them the physical world stands still, drip-drying.

To ensure rain and sunlight, and to keep the subtle balance of nature, Maya priests appealed to Chac, the sustainer of life and the god of rain, who lived deep in the cenotes. (Pronounced *suh-NO-tays*, the word comes from the Maya *dzonot*, meaning abyss.) When drought, war, or other dangers threatened, the Maya performed elaborate rituals and pierced their tongues and earlobes with stingray spines, collecting their blood on parchment for burned offerings. On occasion, a high priest would open a victim's chest with a stone knife and tear out a beating heart.

"Most rib fractures from accidents occur from the outside in," Terrazas said, examining a skeleton, "but ripping out the heart caused breaks from the inside out." He looked up from this horrendous technicality and offered, blandly, "This is a good indication of intentionality."

Such rib fractures would have been welcome news for the archaeological team, clearly signaling a sacrificial victim. None had been found, yet there was still the skull with signs of defleshing, another type of sacrifice.

"At first I didn't think we would find these kinds of sacrifices in rural cenotes," Terrazas said, "but now it seems I was wrong." He grinned. "It's wonderful to be wrong."

Many of the cenotes formed as a result of a city-size meteorite slamming into the region 65 million years ago, generating a global cataclysm. Giant waves inundated shorelines, and fine dust blotted out the sun and cast the world into darkness. Most



scientists now accept that the meteorite helped trigger the K-T (Cretaceous-Tertiary) mass extinction, which included the dinosaurs.

Millions of years later fractures appeared in the limestone that overlaid the perimeter of the 110-mile-wide crater, leaving a ring of underground chambers that filled with rainwater. Over time, the limestone that covered the chambers eroded, thinned, and collapsed, exposing the waters and the complex of fractures as cenotes.

These ring cenotes, whose epicenter is near the village of Chicxulub on the mangrove-fringed north shore of the Yucatán, extend, remarkably, into the sea. At high tide the offshore caves expel fresh water, which bubbles at the surface. Local residents call these fountains *ojos de agua*, eyes of water.

For now the eyes of the underwater archaeologists were on the inland cenote that yielded the skull. While they camped around the entrance, the U.S. documentary team made its headquarters in a small village nearby. I joined the explorers, technicians, and biologists as they hung their hammocks in the village's 16th-century colonial church, on the plaza where the buildings flashed bold colors and music honked as a traveling carnival dismantled its carousels and popcorn stands. It was the week before Holy Week, two weeks before Easter. That first evening our host, the local padre, pulled his VW into the sanctuary and parked between the pews, as he always does, to guard the church. The night air was heavy with woodsmoke and henhouse smells. The sky outside throbbed with stars.

The village was in the *selva espinosa*, spiny forest, a region routinely cut since Maya times, and so ravaged by centuries of grazing animals that the only vegetation left protects itself with spines or needles. Yucatán had once thrived on henequen, or sisal, a spiky agave used to make rope fiber. Sisal peaked in the early 20th century, then collapsed, leaving grand haciendas abandoned and the economy destroyed.

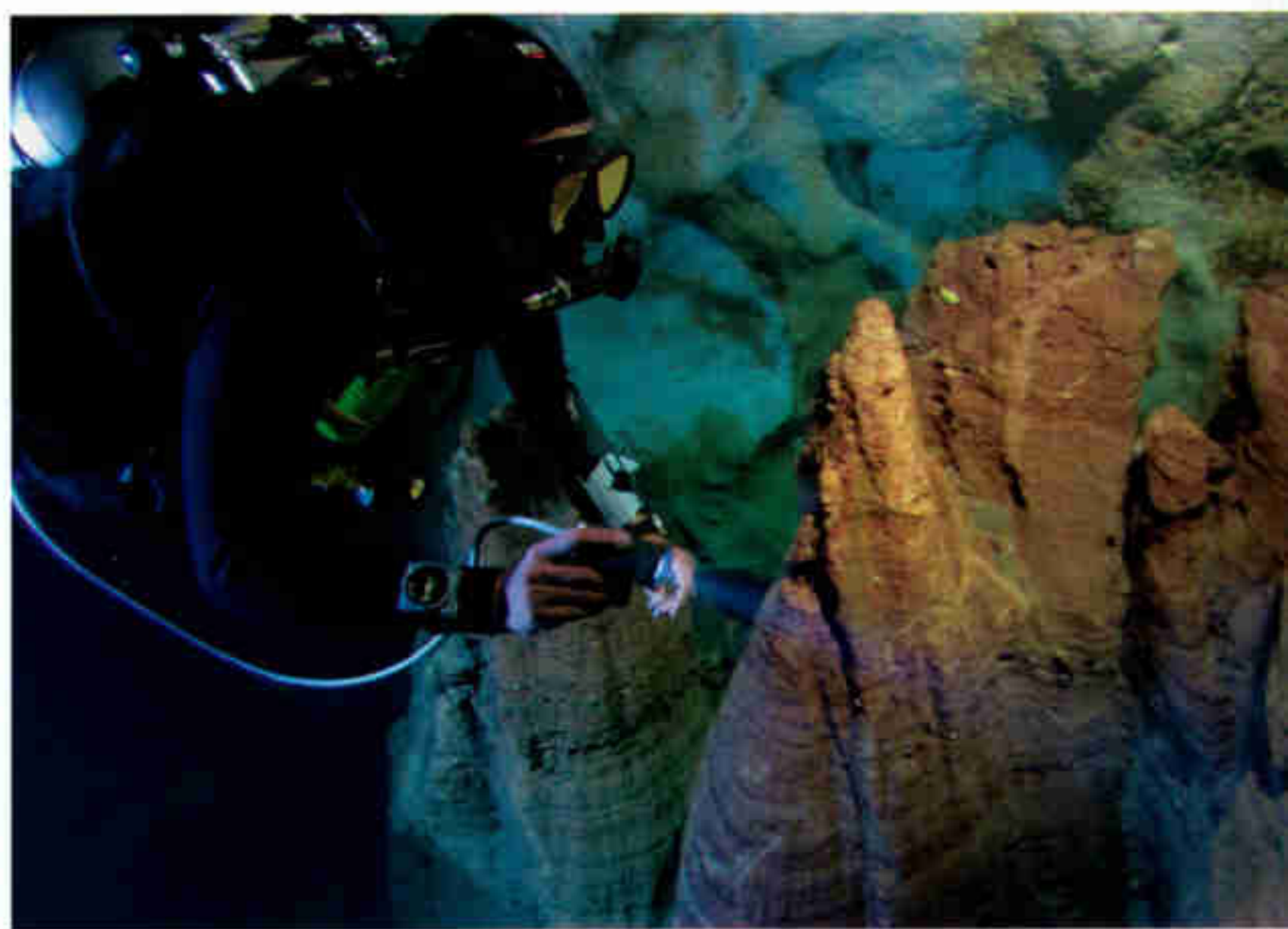
The cenote the teams were exploring is one of about a hundred in the immediate area. At the top, it appears like a simple three-foot-square stone well, sitting in the courtyard of a vine-choked hacienda, where only a few cattle pens remain. An old man, Tenne Chuk Awum, arrives each morning on a bicycle to herd the cattle to pasture and to pump water

from the cenote for their trough. But now the teams had formed a small town here, with roaring generators and air compressors for diving tanks, a dusty parking lot of 20 cars, and more than 250 crates and boxes of gear that weighed five tons.

Wes Skiles's team had lugged two remotely operated vehicles (ROVs), the size of microwave ovens, to the Yucatán to probe below the halocline, the boundary layer where lighter fresh water gives way to heavier salt water.

"I think we've been diving in the attic spaces of this system," said Tom Iliffe, a marine biologist from Texas A&M University who studies aquatic cave-dwelling animals. "Most of the structure of the cenotes is below what we can reach with scuba, which has a limit of about 200 feet deep. It's like the far side of the moon. No one knows what's down there."

Day after day the underwater archaeologists formed an ant-like parade as they descended in masks and black wet suits down the well shaft to silent, sunless waters where most creatures are blind and white. The goals were to map the cenote, locate artifacts, film them as they lay, label them with numbered tags for future



studies, and bring up samples. Canoes and a rubber boat served as diving platforms on the water's surface. Nothing came easy in the cenote. Each diver took three light sources, and two of everything else: breathing tanks, regulators, masks. Some wrestled with cameras, lights, and video equipment, others with slates and pencils. In charge of all these logistics was the third co-director of the project, diving instructor Octavio del Río.

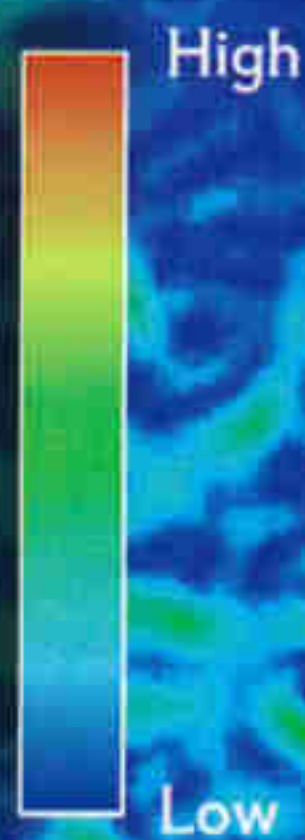
One day the sheer size of the electrical gear



Tom Morris hauls gear to a cenote, part of an archipelago of fractures formed along the rim of a 110-mile-wide crater of a meteorite that hit the Yucatán (below). Over time those fractures filled with water. Connected to the sea through caverns, the water rose and fell with ice ages. When dry, cenotes cracked and eroded (opposite), leaving soil packed with the bones of small mammals, including a now extinct horse, a camelid, and a giant armadillo.

A telltale sign of the meteorite crater emerges in this gravity model: Readings are higher along the crater's perimeter, site of the ring cenotes. A 200-pound person standing on the rim would weigh 199.998 pounds inside the crater.

Gravity gradient scale



• Cenote
 □ Maya ruin

0 mi 20
 0 km 20

Chicxulub meteorite crater

Gulf of Mexico

Present-day shoreline

Cenotes

Chicxulub

Dzibilchaltún

Mérida

Chichén Itzá

Yucatán Peninsula
 MEXICO

SOURCES: ALAN HILDEBRAND, UNIVERSITY OF CALGARY;
 MARK PILKINGTON, GEOLOGICAL SURVEY OF CANADA
 NATIONAL GEOGRAPHIC MAPS

and lights blew the circuit breakers. None of the winches worked, and the batteries for the lights had drained like dishwater. The teams ended up hauling equipment and men by hand, like stevedores, up and down with a rope attached to a metal basket. They later settled for an old, muffler-challenged VW that belonged to one of the workers. The car became the winch.

But the system was hazardous. Once four 60-pound diving tanks broke loose from the lift and plummeted through the shaft, wiping out part of the lighting system laboriously laid just above the water. The tanks missed diver Scott Braunsroth by about a foot.

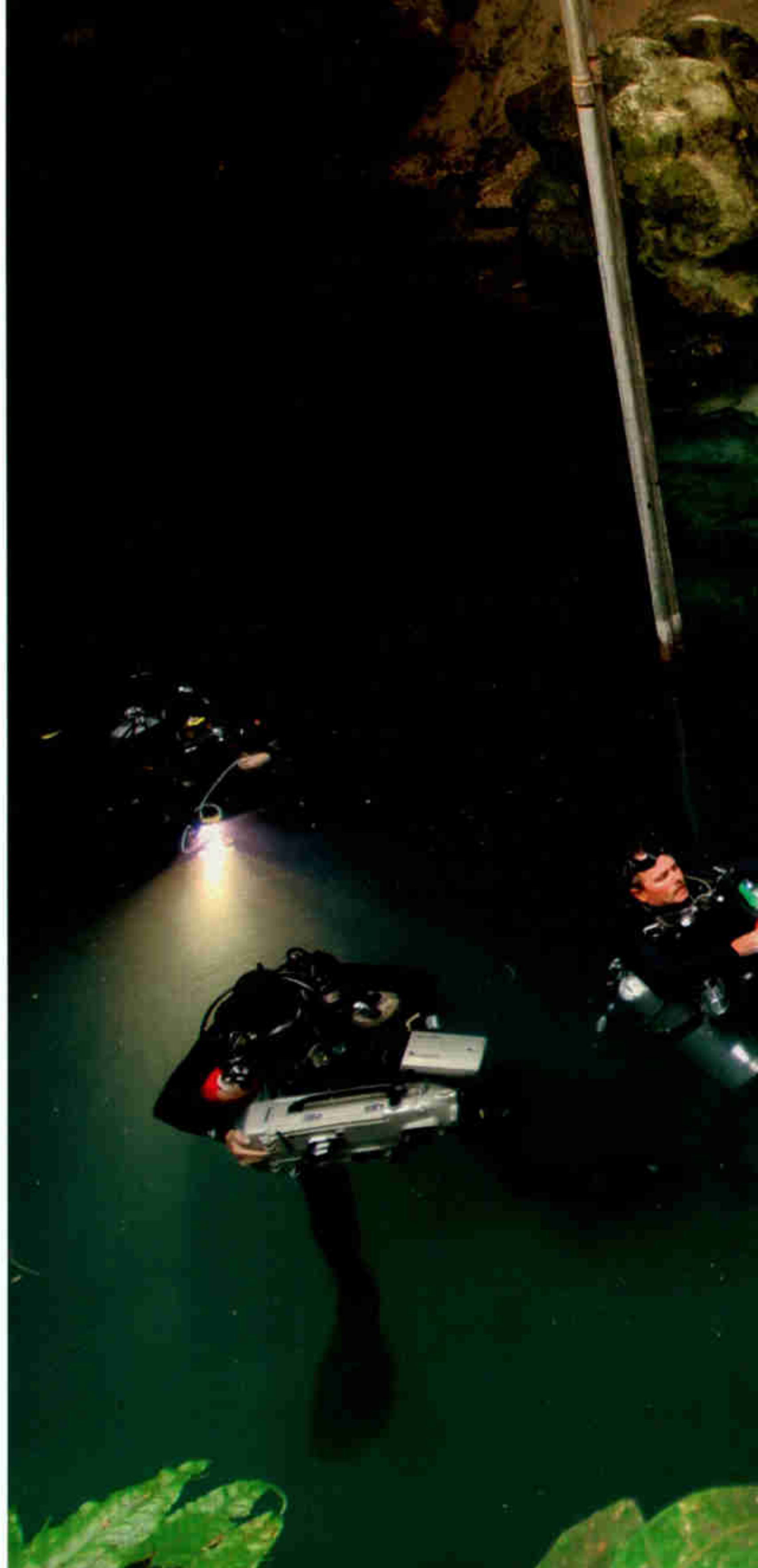
Pedro Tum Ortiz, one of the local men who'd been supplying muscle to the ropes, later confided, "Holy Week is a dangerous time to go to the cenotes. God is resting, and the waters will move. Sometimes you hear noises, cocks crowing, and jaguars. Once I went to a cenote with friends to bathe, and we had to grab on to the ladder so the water wouldn't suck us under."

On the third day it was my turn to test God's vigilance, letting the metal chair plop me down into the cool pond like a piece of bait. Treading water, I adjusted my eyes to the moonlight of the cave. The cenote was shaped like an old Chianti bottle—a narrow neck leading to a wide chamber about 90 feet across and 120 feet deep. The bottle was half full, the water surface 35 feet below the domed ceiling. Stalactites dripped, and the roots of trees were spread on the walls in delicate dark webbing. Spanish records tell how live victims were

thrown into the sacred cenote at Chichén Itzá, a major Maya city, on the premise that, as sacrifices to the gods, they would not die—even though they were never seen again. I scanned the slick limestone walls, and my heart pounded, feeling their terror.

"WE'VE BEEN diving in the attic of this system," said biologist Tom Iliffe. "It's like the far side of the moon. No one knows what's down there."

Sinking deeper into the white noise of pressure, I bottomed out at 50 feet and glided across piles of shattered limestone. A side cave, shaped like a sock, spun down and off to the west. Resting in the sand was a mahogany-hued skeleton,



Cenote waters plummet hundreds of feet into darkness, home to eyeless fish like this four-inch-long *Ogilbia pearsei*. Deeper still, some of Earth's oldest crustaceans thrive in oxygen-starved waters. Equipped with powerful lights and yellow rebreathers for long dive times (above), a U.S. documentary team carefully enters a cenote to test remotely operated vehicles in this new environment. An ROV (right) transmitted still photos and video images of animals.



already tagged, the eye orbits of its skull bleak with expectations of eternity.

A few days later the INAH scientists brought him up. It was the first skeleton of its kind—with all its bones in their natural positions, undisturbed—ever found underwater in the Yucatán. He was a large man, perhaps 50 years old, well past the Maya life expectancy. “His health was bad,” said Terrazas after examining the bones, “with arthritis so severe that he could barely flex his hands. He had terrible teeth problems—gingivitis—and he probably had a very hard time chewing.”

He was lying face up on the sand. Was it an accident? “No,” said Terrazas. “There are nine skeletons down there [eight are partial]. Maybe one is there from an accident, but not nine.”

When the car winch pulled up the bones of the old man, the three women who had made quesadillas for us the previous night were standing by the well. I asked them what they thought of our mission.

“We didn’t expect skeletons,” said one, Olegaria Chiku. “For us, a cenote is just a hole with water. But my mother lived around here, and she said that we needed to give the cenote 15 virgins, and God would open up a road to bring in the gold that we know is down there.”

Until the 1960s many people, including many archaeologists, thought virgins were the only individuals whose stories had ended in the cenotes. “We learned then that they were not all young girls,” said Carmen Rojas, the underwater archaeologist who oversees data processing for the survey project. “And now we know that they were not all sacrifices.”

The most striking evidence came one Saturday afternoon when Wes Skiles discovered what turned out to be one of the most important finds of the expedition. Only eight feet underwater, in a small hidden niche, was a full skeleton in a funerary position on its back, its



“Each cenote is a box of surprises,” says project co-director Octavio del Río (right), who holds one of 115 skulls found in what may be a funerary deposit (left). Only a few were brought up for brief study (above) or transported to Mexico City. “We’re not making a museum collection,” says Judy Logan. “This is a situation where you have human sanctity and emotion.”



Peering down into a chamber beneath the seafloor 400 yards offshore, diver Andreas Matthes confronts the rushing current of a freshwater fountain. These sites are part of the interconnected system of more than 3,000 cenotes that underlies the Yucatán. At high tide they blow out fresh water; at low tide they suck salt water back into the system.



knees up. In front of it were three ceramic pots of offerings, one containing the skull of a dog. The bones of a bird lay buried in the silt nearby. The Maya held both animals to be supernatural, often mixing their physical features in art and legend. They were to the Maya, as to the Aztec, potent symbols of death. The remains must have been deposited there when the water level was lower, said Rojas, by people swimming with the body, or using a boat.

"The condition of all the bodies we've found tells us that the Maya deposited their dead in cenotes in at least two ways," she said. "Some bodies were deposited with care, while others were thrown into the water."

The day the archaeologists brought up the skeleton, the old herder from town showed up wearing a white shirt, his Sunday best, and sat solemnly by the well. "I just wanted to watch my ancestors come home," he said.

There would be other ancestors. By the second week the INAH team members had charted the remains of 15 individuals. In the mornings they would huddle around a computer screen to review the finds. After everyone had weighed in, Rojas and González would select the items they wanted to bring to the surface for study.

"By bringing the conservation lab and specialists of many disciplines to the sites, we can make a diagnosis quickly," said González. "It has worked well. We will be analyzing our results for years to come."

The finds here in the countryside are much different from those at extravagant cities like Chichén Itzá and Dzibilchaltún, said Terrazas. "Here we don't have the rich deposits of gold and jade."

To explore the offshore half of the ring, Skiles's documentary team drove to the coast, hired a fishing boat, and motored up to a fearsome boil on the sea surface a quarter mile out, as the wind raked the water into whitecaps. The hole was expelling fresh water; low tide would reverse the flow. Veteran cave diver and biologist Tom Morris dived in with mask and fins. "It goes down into a small hole about the size of a manhole cover," he said when he surfaced. "It's gonna be a kick-butt flow."

We threw on our scuba gear and plunged in. Skiles and Morris forced themselves straight down into the cave, like swimming into a fire hose. I followed them, gripping the rocks, pulling through the blurry convergence zone of fresh and salt water, pumping furiously with my fins.

A disk of brilliant blue shone at the bottom of the tunnel. It was Morris's lamp in the clear water, but it looked like the bright eye of the sea, as wondrous as anything Alice saw down the rabbit hole.

Soon after I caught up with them, Skiles and Morris disappeared, penetrating the two caves that led off from the bottom. I waited and waited and then returned to the boat. They were gone for two hours, under the sea, under the ground. I worried.

But they came back happy as puppies. Both fractures ran in line with the rim of the old crater, Skiles said, confirming that we were on the ring; one was reaching toward a spring in a mangrove swamp that we had already explored. They followed one for at least a thousand feet, wriggling through crevices so narrow that their face masks were dragging in the mud. Foot by

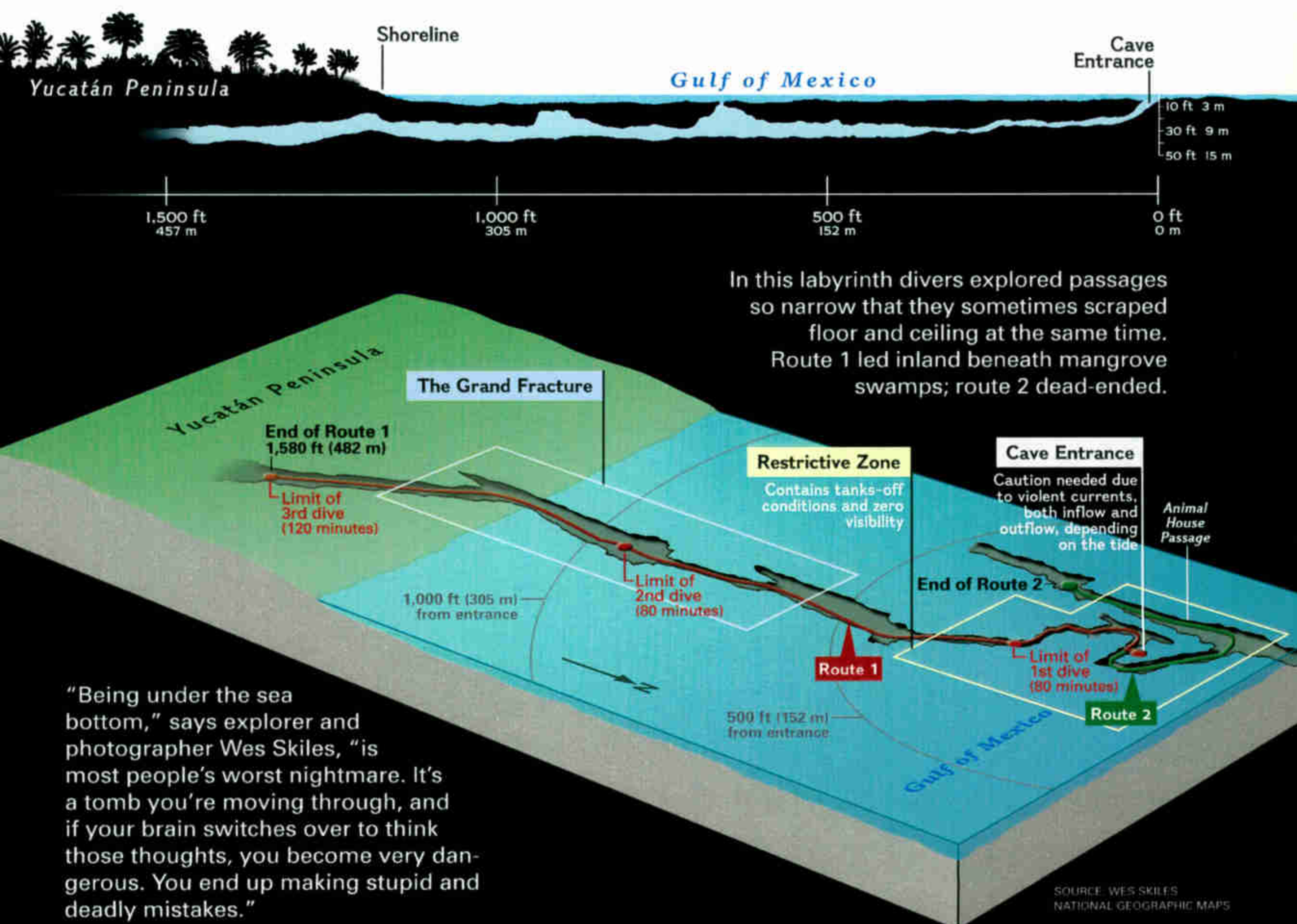
NORTHERN YUCATÁN is tough, prickly country—a slab of limestone roughed over by scrub forest. It has no rivers, no runoff. Rain percolates swiftly into the cenotes and flows to the sea unseen.


gritty foot, pushing the limits of human ability, they were burrowing into the corpus of the ancient disaster site, a vast underground world that has defied examination.

"It's inhuman to lie comfortably in that scenario," Skiles said later. "Being under the sea bottom, one by one your senses are taken away from you. It's most people's worst nightmare. It's a tomb you're moving through, and if your

brain switches over to think those thoughts, you become very dangerous. You end up making stupid and deadly mistakes."

The cenotes are true time capsules, and the Maya finds were only part of the yield. Debris and deposits have rained into the cenotes for centuries, and depth and darkness have protected them. The rise and fall of ice ages is written on their walls, and the fossilized bones





A subterranean sun radiates from divers' floodlights in a freshwater fountain in the ocean. For the ancient Maya, cenote waters were the fount of fertility and life, home of the rain god, Chac, and the entryway to an underground world that is just beginning to be fully understood.

of prehistoric animals are preserved in their sediment. The INAH team found fossils that are 10,000 to 20,000 years old—a camelid, a giant armadillo, an extinct horse. All are from the Pleistocene, a time when the Yucatán Peninsula was covered not with low forests but with dry grasslands.

It was Good Friday when we left the inland cenote and hauled all the gear to the front room of the church. A procession of villagers was re-creating the stations of the cross. Jesus was portrayed by a young man with a beard painted on his chin. “All my work involves the way human beings confront their death,” Terrazas had said weeks before, “because it’s a good indication of the way they have confronted their lives. We need this death in order to understand life. The key moment of Christianity is also a human sacrifice—the Crucifixion. I think we are touching on some delicate parts of the human being.”

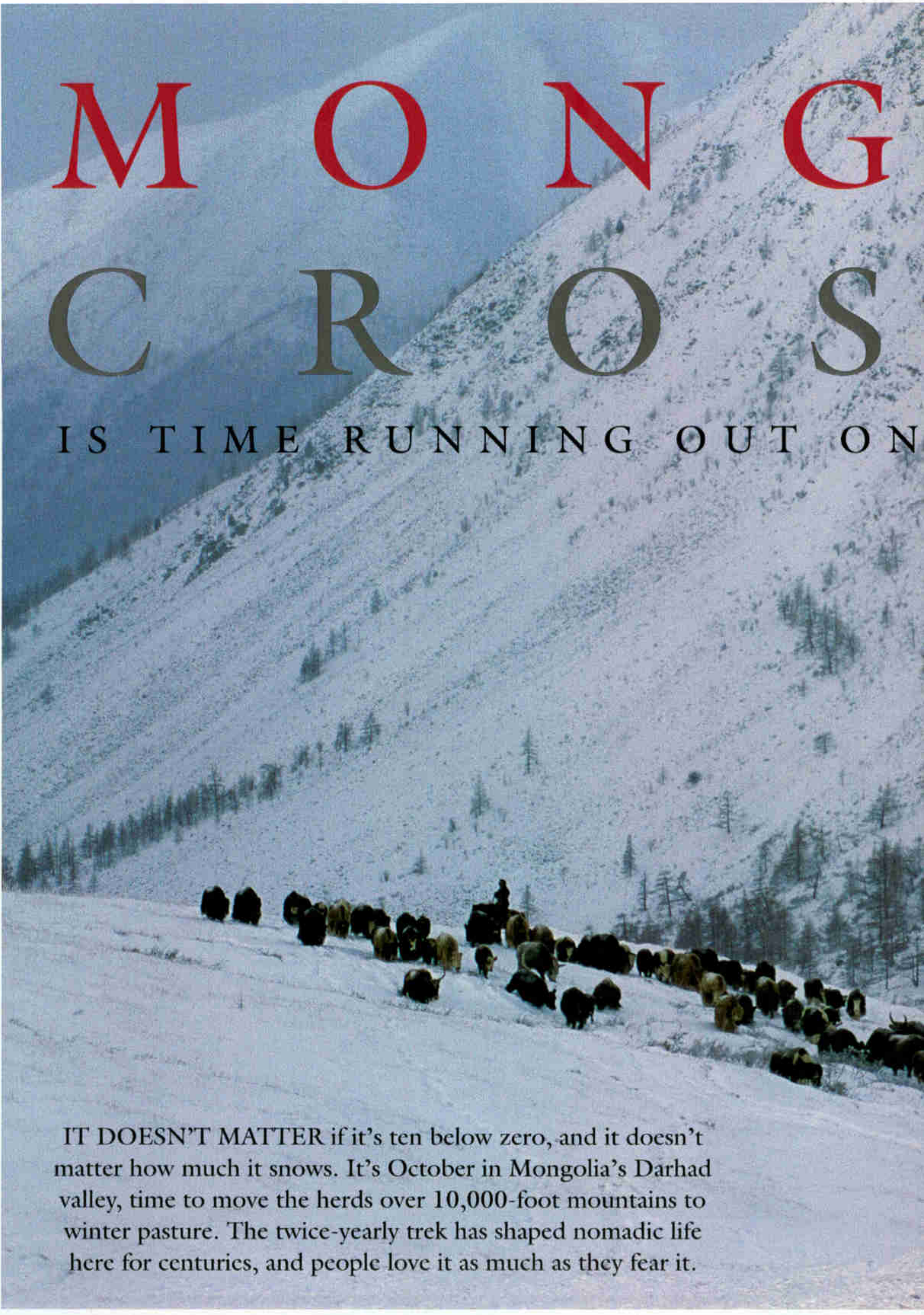
At the church, right by our equipment room, Jesus was raised up on the cross, his feet resting on a small platform. Mary mourned. And then, when the villagers had carried him away, there was a joyous rush for the cold rice-water drink, served every year on the corner of the church steps.

That night the padre’s VW again sat, bug-eyed, between the pews. I hung my hammock in the hallway, between the damp walls, and suffered through the mosquitoes until the roosters crowed. The sun rose. It would set tonight. And it would rise again, confirming the Earth’s capacity to amaze. □

WEBSITE EXCLUSIVE

Learn how explorers and underwater archaeologists brave danger and work together to protect the cultural heritage of the Yucatán at nationalgeographic.com/ngm/0310.





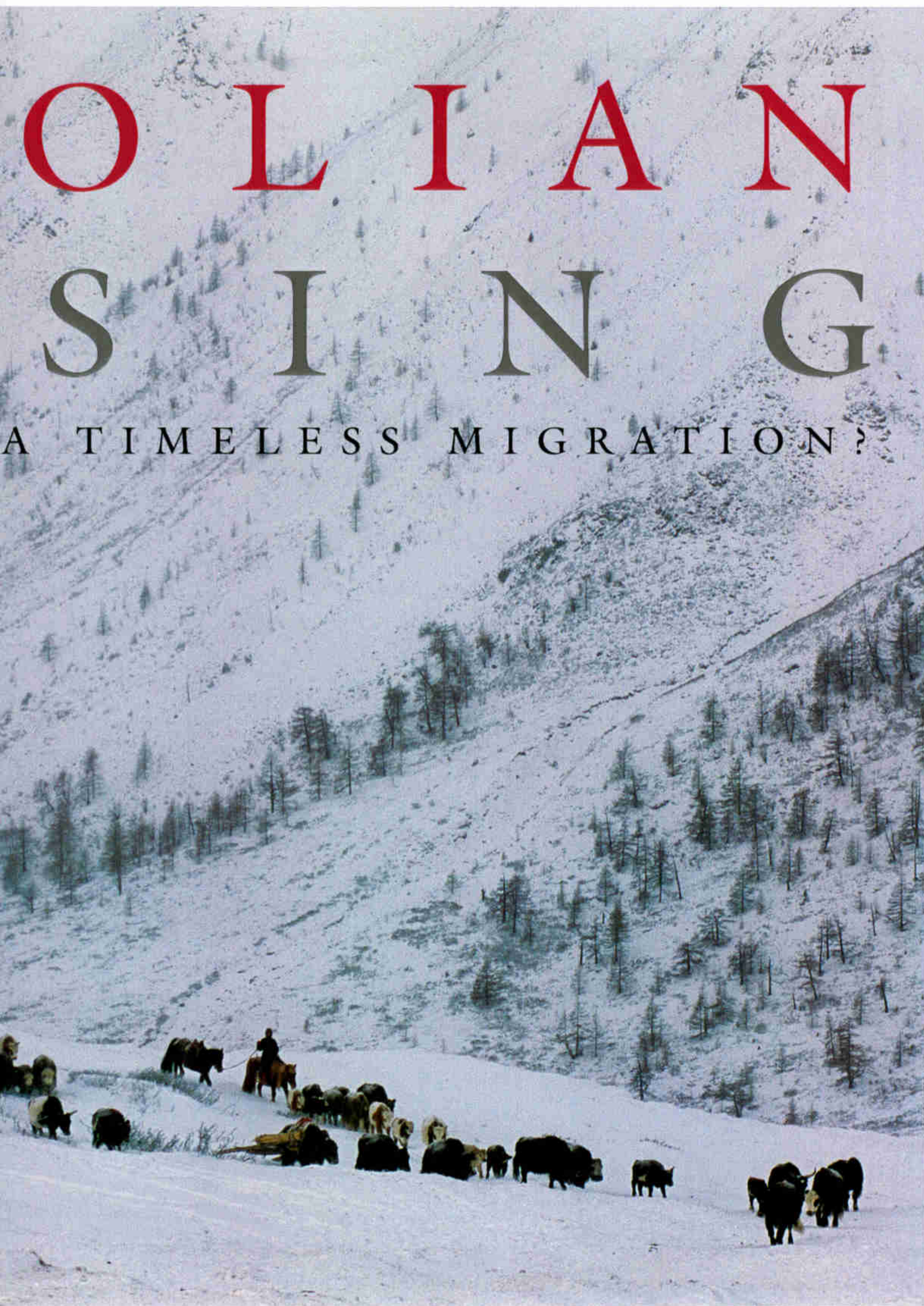
MONG CROS

IS TIME RUNNING OUT ON

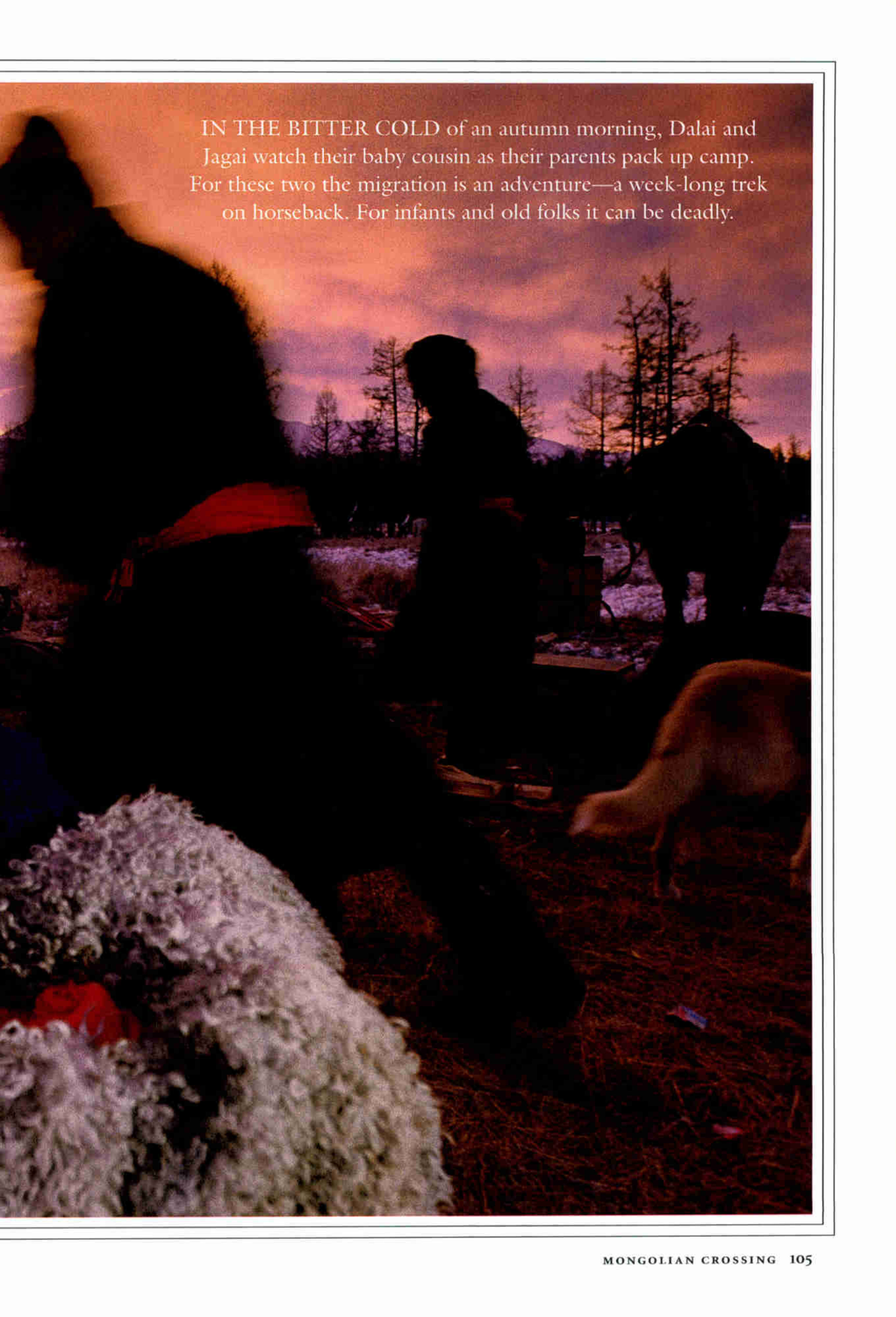
IT DOESN'T MATTER if it's ten below zero, and it doesn't matter how much it snows. It's October in Mongolia's Darhad valley, time to move the herds over 10,000-foot mountains to winter pasture. The twice-yearly trek has shaped nomadic life here for centuries, and people love it as much as they fear it.

OLLIAN SING

A TIMELESS MIGRATION?





A photograph showing a person silhouetted against a sunset sky. The person is standing in a field, possibly a campsite, with horses and a dog visible in the foreground and background. The sky is a mix of orange, pink, and purple, suggesting dusk. The person is wearing a dark jacket and a hat. The overall mood is somber and contemplative.

IN THE BITTER COLD of an autumn morning, Dalai and Jagai watch their baby cousin as their parents pack up camp. For these two the migration is an adventure—a week-long trek on horseback. For infants and old folks it can be deadly.



BY GLENN HODGES

NATIONAL GEOGRAPHIC WRITER

PHOTOGRAPHS BY GORDON WILTSIE

THE OLD MAN HATES IT that he can't talk. As his wife tells us about his recent stroke, he pulls the blanket over his head and lies there in bed, peeking out. It's a seven-day trip over the mountains to their winter camp, she explains, and he's too weak to ride a horse. "Somehow we're going to take him," she says, "but I'm not sure how." They'll probably have to tie him to a stretcher attached to two long poles and pull him behind an ox. It's rough terrain, and temperatures are already well below freezing.

The old man, whose name is Purevsh, pulls the blanket from his face and calls to his son to help him sit up—"da da da da da da." Once they get his emaciated body upright, Purevsh looks around the room, his eyes brimming with tears. He knows what everyone's thinking: He's going to die in the mountains.

People have been crossing the mountains in northern Mongolia, and dying in them, for generations. When fall comes to the Darhad valley, hundreds of families load up their oxen and move their sheep, goats, and cattle to winter camps where the grass is long enough to get the herds through until spring, and where the weather is a good 20 degrees warmer. Between the 1,300-square-mile valley and the winter camps stands a wall of 10,000-foot, snowcapped peaks that can be as brutal as they are beautiful.

By now, early October, photographer Gordon

Wiltsie and I have met many families who planned to travel along four routes through the mountains, but this is the first time we've seen life and death hanging in the balance. With us in the *ger*—the Mongolian term for a circular felt tent—is Cliff Montagne, a friend of Gordon's who has been working in the Darhad for six years doling out small grants and microloans as part of a regional development program he started at Montana State University. After taking a few minutes to let the family's predicament sink in, Cliff comes up with an idea: He will give Purevsh and his family money for gas, about \$120, if they can find someone to drive a truck to their winter camp—the long way, skirting the mountains.

As Purevsh's wife, Tsegmed, explains the stranger's offer to him, he swallows hard and his lip begins to quiver. "These people want to help us," she tells him gently, and the grief he's held back since we arrived pours out in a torrent of sobs. It's such a wrenching moment that everyone looks away. After a time Tsegmed wipes her

CULTURED IN SPIRITS human and animal, the people of the Darhad rely on horses for transportation and shamans for guidance. But even out here change is life's only true constant. For the price of four cows, a family can buy a TV and solar-powered satellite dish.





AN OX-BACK RIDE is sometimes dangerous and always rough, but there's no other way to go: The adults are too busy herding to babysit. With tourism and development on the horizon, the next generation may find a new path.

husband's face, lights him a cigarette and then one for herself, and they smoke with tears still in their eyes. "Virtuous people came to our house today," she says as we get up to leave. Cliff himself is crying as soon as we're out the door.

It seems like such a simple equation. "I was thinking of purchases I made to come on this trip—I bought a vest for \$130," Cliff says later. "I couldn't just walk away." But the irony of what Cliff has done is not lost on any of us. We came here to document this migration while it still exists—it's much of what makes life in the Darhad special, and it may be just a matter of time before herders start migrating by truck instead of oxen. And here we are, making it possible for a family to travel by truck.

BEFORE I CAME TO MONGOLIA, I was enamored with the notion that you can get on a horse at one end of the country and ride all the way to the other side—roughly the distance between Denver and my home in Washington, D.C.—without hitting a fence or a paved road. When I read about Prime Minister Nambaryn

Enkhbayar's plan to build a highway across the country, and his dream of having 90 percent of the population settled in cities by 2030 ("In order to survive we have to stop being nomads," he told one reporter), I cringed. From his seat in Mongolia's capital city, Ulaanbaatar, he saw a backward country that needed to step into the modern age. From my seat in the traffic-choked streets of Washington, I saw the last unruined place.

But how do you judge salvation or ruination? Cultural change is a tricky phenomenon, bringing with it a bundle of trade-offs that aren't necessarily obvious at first glance. Consider the impact of the Soviet era. Until 1990 the Soviet Union had Mongolia in a tight lock for more than six decades. Under direction from Moscow, Mongolia's socialist government obliterated the country's Buddhist establishment, killing lamas by the thousands and destroying the temples and monasteries that were the strongest institutions that most villages had. The government pressured herders to relinquish their animals to collectives and imposed bureaucratic strictures on a people who had rarely lived by clock or ledger.

Then again, most of those people had never learned to read either, and with Soviet aid Mongolia built schools across the country and brought virtually 100 percent literacy. Pensions, free health care, and regular salaries made the lives of herders less harsh and unpredictable. Perhaps most significantly, the Soviets kept the Chinese out. China had long regarded Outer Mongolia as part of China, and it wasn't until 1921, when Russians helped oust Chinese troops, that Mongolia shook free of the Chinese yoke. One look at China's Inner Mongolia, where ethnic Mongolians have been forced to settle on smaller and smaller pastures as Chinese farmers have poured in to take the best land, and it's hard not to see the Soviets as somewhat of a salvation.

For nearly 70 years Mongolia fielded socialism's mixed bag of costs and benefits. Now that socialism is out of the picture, Mongolia faces a whole new set of trade-offs.

THE BIG NEW THING in the Darhad valley is solar-powered satellite TV. Every year a few more of the six-foot dishes dot the steppe, and at night the gers next to them grow quiet in the glow of small black-and-white sets. The dishes only pull in one channel—Mongolian Television, which

serves up an odd stew of badly dubbed Hollywood movies, judo competitions, government talking heads, and shampoo commercials—but one day soon people in the valley will surely get MTV and all the other channels available in Ulaanbaatar, and the number of dishes will multiply accordingly.

For the moment, though, most families in the Darhad still entertain the old-fashioned way, and Batnasan's family is one of them. The 49-year-old matriarch and her kids and grandkids, who live near the town of RENCHINLHUMBE in the central part of the valley, have agreed to let me go with them as they migrate over the mountains to the east. On my first night in their ger, seven-year-old Lhagwaanaa asks if she can sing for me. Of course, I say, and she belts out her favorite song, "My Father Is A Horseman," her voice strong and raspy like her grandmother's.

"Sing your cow song," her grandmother says.

"Now you're telling me what I should sing?"

Lhagwaanaa says, drawing laughs. Then she raises her hands and sings a song of more recent vintage. "My brother is calling me from far above—he looks like he's in the sky—I want to be a construction worker just like him, in buildings way up high." Then she stops singing and

begins what appears to be a familiar routine. "I want to go to the city," she announces. "I'm going to tell my father to put me on the truck to the city."

Doesn't she want to be a herder? I ask. "Why would I want to be a herder? I'm not going to be a herder! I'm going to be in the city, where I'll have clothes to wear!" With that she says a dramatic goodbye, walks out into the night air, and yells to the sky.

Life is hard in Batnasan's family. Her husband died in 1996, so she's now responsible for a household that includes two of



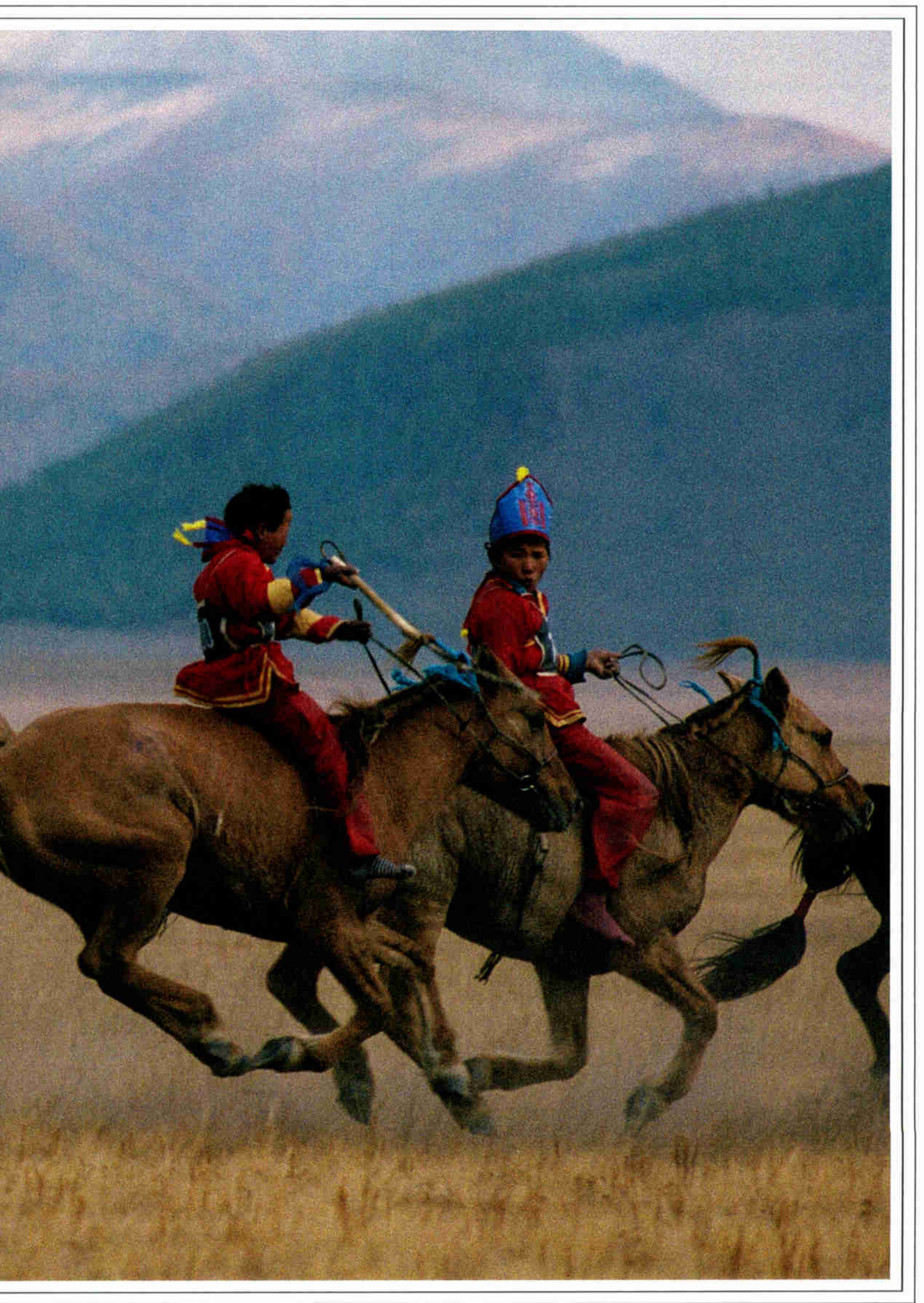
WHERE GRASS IS GREENER

Each fall a thousand people and some 60,000 animals leave the Darhad valley and travel 40 to 70 miles to winter pastures near Lake Hovsgol. Then each spring they come back. Why? Because by fall the Darhad's grasses have been shorn to nubs, and frigid Siberian air is starting to squat in the mountain-ringed valley like an uninvited guest. Meanwhile, on the other side of the mountains, the air is 20 degrees warmer and the grass is as high as a sheep's belly.



BAREBACK AND BAREFOOT, kids display the same Mongolian horsemanship that helped Genghis Khan's 13th-century armies conquer much of the known world. Now the world is returning the favor, as Western economics and culture invade a country that has been relatively isolated for centuries.





her grown daughters, her son and his wife, and three grandchildren, two of them infants. It becomes clear very quickly that the family is shorthanded. When it's time to bring in the cattle and rope up the oxen, they tether the babies inside the ger and leave them crying until the job is done. "Usually men do this work," my translator, Achit, tells me. "But they don't have men."

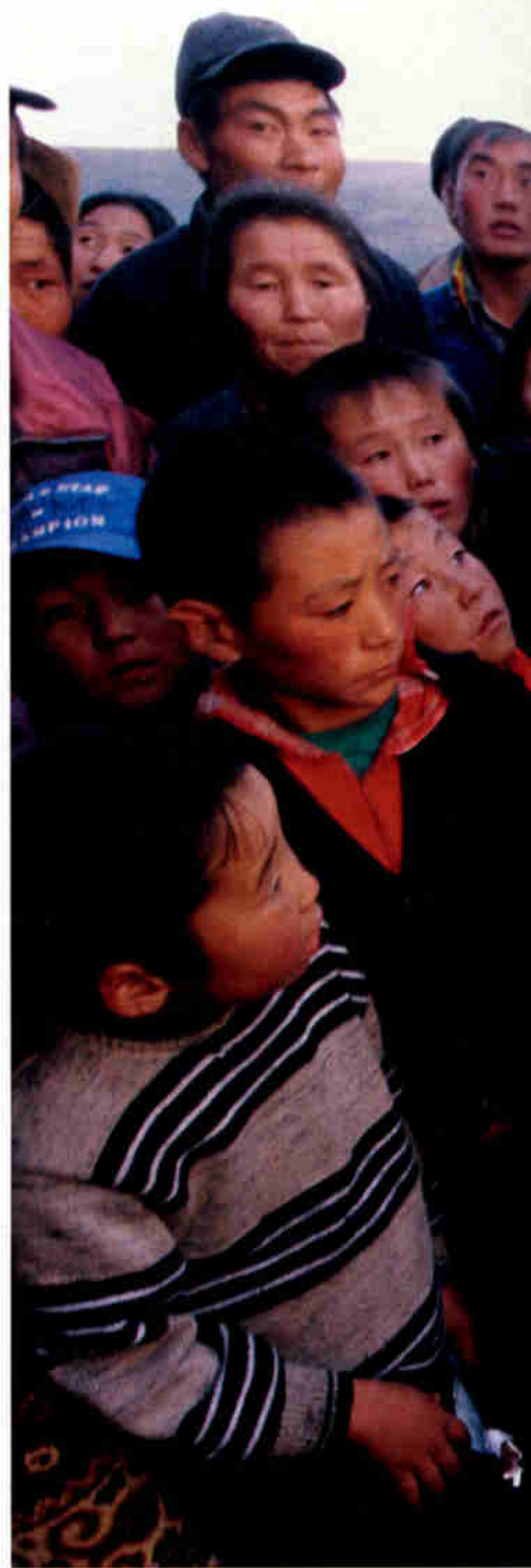
Good thing Batnasan is tough. Her forearms are rippled with veins, and though her eyes are warm, she speaks with a masculine punch. The next afternoon, as she squats on a hill above her ger trying to find her horses with Russian binoculars, she explains how her life has changed since 1990, when socialism ended and the Soviets withdrew subsidies that had made up a third of the country's economy. She lost her job at the state-owned textile factory 70 miles away in Hatgal, where she'd worked for 20 years. Her husband lost his job at the town's school, and like thousands of people in similar circumstances across Mongolia, they returned to the herding life they had known as kids. "It was good to herd again," she says. "But now everyone has to bear his own burden. People have their own animals, but no one has cash."

I ask her what she thinks of the prime minister's idea of having nomads relocate to cities. "I don't like to think of people not herding animals, but right now it's hard to make a living without jobs." People in the capital, she says, can make as much in a month as she makes in a year.

THE WORK STARTS EARLY on migration day. Batnasan's family is up before sunrise to take down the ger and start packing the oxen, and Boldbaatar, a friend of the family who will help herd as far as the pass through the mountains, heads out to find the horses. It always takes longest to get ready the first day, they tell me, but we're moving by nine—a caravan of 400 cattle, sheep, goats, and horses, plus 17 oxen loaded with cargo that includes the two babies tucked into open crates. It's an exhilarating spectacle as we cross the sunny prairie toward the snowcapped peaks, the dogs racing through the herd, the cattle jostling for position, our wrangler Nyamhuu singing from the saddle. I pick up a few of the howls and grunts used to keep the animals moving—my favorite sounds like an angry, abbreviated sneeze: "Ach!"—and gallop after strays, hollering like a madman.

With the mercury creeping toward 60°F—rare for the second week of October—I turn to Boldbaatar and Davaanyam, Batnasan's grown son, as we whistle and holler behind the cattle. "This the best thing about being a herder?" I ask, and they both crack huge smiles. "Te," Boldbaatar says. "Yeah."

Boldbaatar, whose name means Steel Hero, has a dark intensity true to his name. His eyes are restless, his mouth long and drawn, and when he lights a cigarette, he stares at the flame of the match solemnly, like it bears some sort of wearying news. He has a bloodcurdling cry that never fails to send the sheep scurrying; it sounds like the howl of some trapped beast. And to an extent, he is trapped. He herds his animals in the summer but gives them to Batnasan for the winter because he has to stay in town for his three kids, two of whom are in school. And for those





A WRESTLER TOASTS HIS VICTORY in a premigration festival by flinging fermented mare's milk into the crowd. Mongolian legends claim wrestlers began wearing open-chested shirts after a woman won competitions disguised as a man.

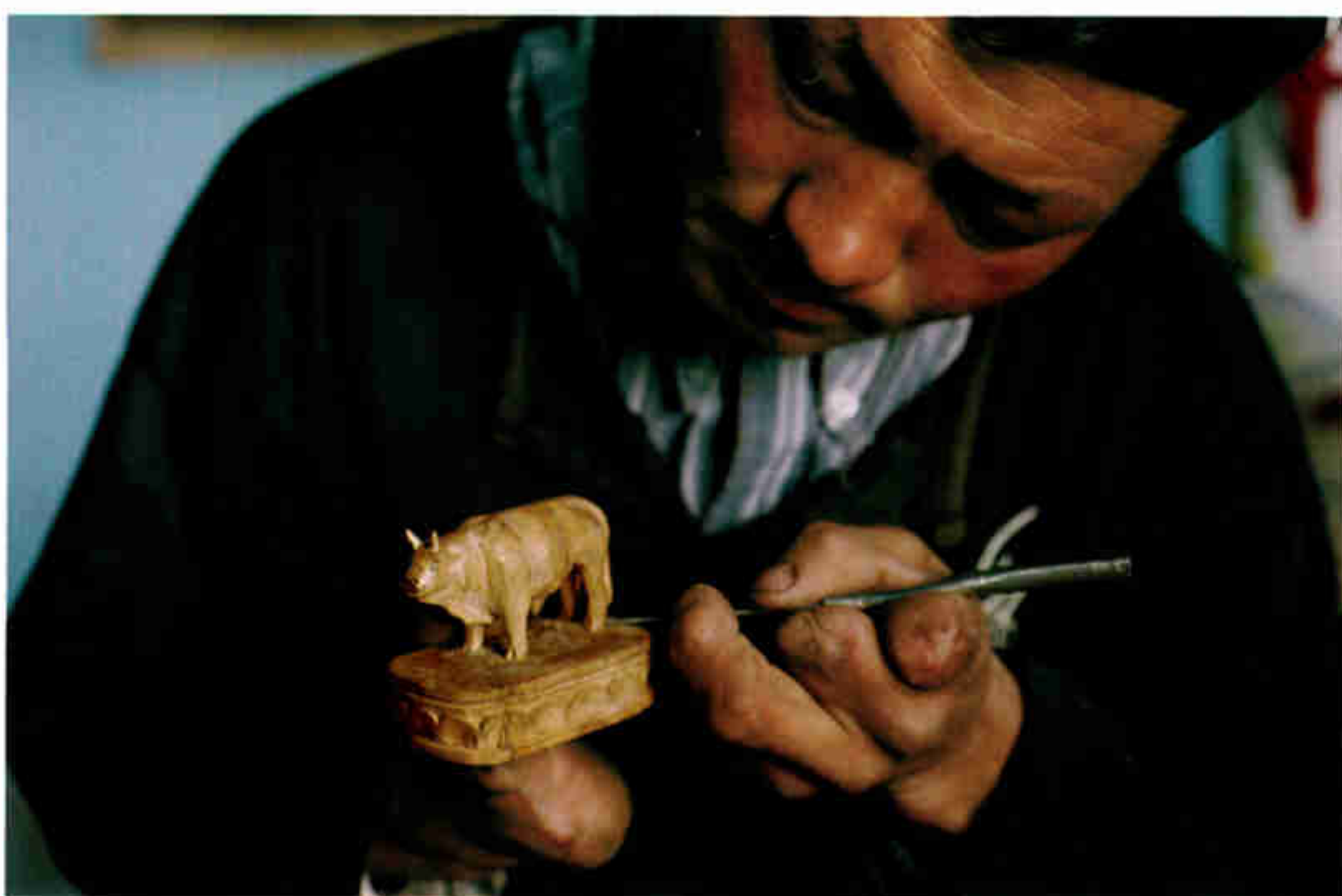
six months he has nothing to do—there are no jobs in Renchinlumbe, the largest of the valley's three towns, with more than a thousand people. His kids love being in school, but for him, "life in town is really hard," he says. "I wish I could stay with my animals."

The second day on the trail is as glorious as the first, and I'm at risk of getting an overly rosy idea of what migrating is like until Tsogbadrah, another friend of the family who has met up with us for a short part of the ride, tells me about his trip from his winter camp back to the Darhad in March 2000. He and his family were moving through the mountains when a blizzard struck,

dumping snow "up to a horse's stomach." He lost track of his cattle and horses, and then his wife and daughter. He had to bundle his granddaughter up in his robe to keep her from freezing and feared they were both going to die. By the time he found the camp, three of the gers had blown down and only one remained upright—with his wife and daughter in it. "I was so relieved I cried," he says. Two of his cattle died standing, buried in snow, with holes peeking through where they had been breathing.

That year Mongolia had a *dzud*, a harsh winter following a dry summer that makes it hard for animals to get enough grass to survive until





MANY CHILDREN SAY GOODBYE when fall comes, staying in boarding school (left) as their families migrate to winter camp. The separation can be painful. Uuganjii (above) was nine years old when he ran away from school to follow his parents. He made it 15 miles before collapsing. “I had no idea it would be so cold,” he says. Found by a hunter the next day, he lost his lower legs and many of his fingers to frostbite. Unable to live as a herder, Uuganjii became an expert carpenter and carver.

spring. The next winter, another dzud; this time Tsogbadrah lost almost a fourth of his herd, and Batnasan lost more than 20 animals. By spring 2002, after three dzuds in a row, more than a fifth of Mongolia’s 33 million livestock animals had died, and thousands of herders had streamed into towns and cities looking for some way to live—prompting the prime minister’s comment that Mongolians had to stop being nomads in order to survive.

When Batnasan hears about Purevsh, the old man who’s migrating by truck thanks to Cliff, she says, “I would go by truck if possible.” This surprises me given how many times she’s already said how great the migration was going and how much fun it is with us along. But it’s less surprising when I remember the ruckus earlier in the day when the ox carrying the babies started mounting and butting other cattle in the herd, and when I remember that over the years a number of infants have died on the migration through these mountains.

AS CLOUDS GATHER on our third day out, we cross the high mountain pass that is our main obstacle, giving thanks for the safe passage at the summit with an offering of vodka. Our timing is perfect: That night it snows. In the morning we break camp before first light, and it’s clearly a cold new season as we make our way down the dry rocky riverbeds. It’s easy going though—the snow is shallow and the cattle and sheep are as fat as propane tanks. On the way back in the spring, the snow will be thick and the animals will be thin, and nothing will be this easy.

Because the summer has been so dry, there may be no water at the winter camp, so Batnasan decides to stop at a site two days short of our final destination. The family will rest several days here in the lee of a mountain ridge, then send someone ahead to check the winter camp for water. If there is none, they’ll have to stay here until enough snow accumulates to provide reliable water, which could take days or weeks. The weather worsens as we wait, and on the second



THE DAY'S RIDE DONE, 13-year-old Bogii unloads an ox in the falling snow. A round *ger*—made of felt over a wooden frame—can be set up in a matter of minutes, and a woodstove can have the hut short-sleeve hot by the time the tea's ready.



day we're playing cards by the woodstove when son Davaanyam bursts into the ger.

"Wolves are chasing the horses," he says. The herd was behind the hill last night, but he's spotted wolf tracks—"the size of a palm"—and the horses are nowhere to be seen. He was out looking for a couple of hours, but it's bitterly cold, and he decided he'd better suit up and eat something before he heads out to find them. They could be a half day's ride away by now.

Davaanyam grabs a .22 rifle, and we saddle up our horses, which were tied up apart from the main herd. As we ride up the mountain behind the ger, I finally get a taste of how punishing this life can be. The wind is fierce and frigid, and my face goes from stung to numb in seconds. The terrain is steep and slowgoing in the slick snow, and I'm profoundly relieved when Davaanyam spots the horses clustered near the top of a distant ridge. We circle around and ride up the back side of the ridge so we don't scare them in the wrong direction, and there we find wolf tracks. Nyamhuu, the wrangler, grabs the rifle, and we take off on foot, my translator, Achit, and I huffing and puffing behind him. The tracks go around a rock outcropping and then double over *our* tracks. The wolves have been following us!

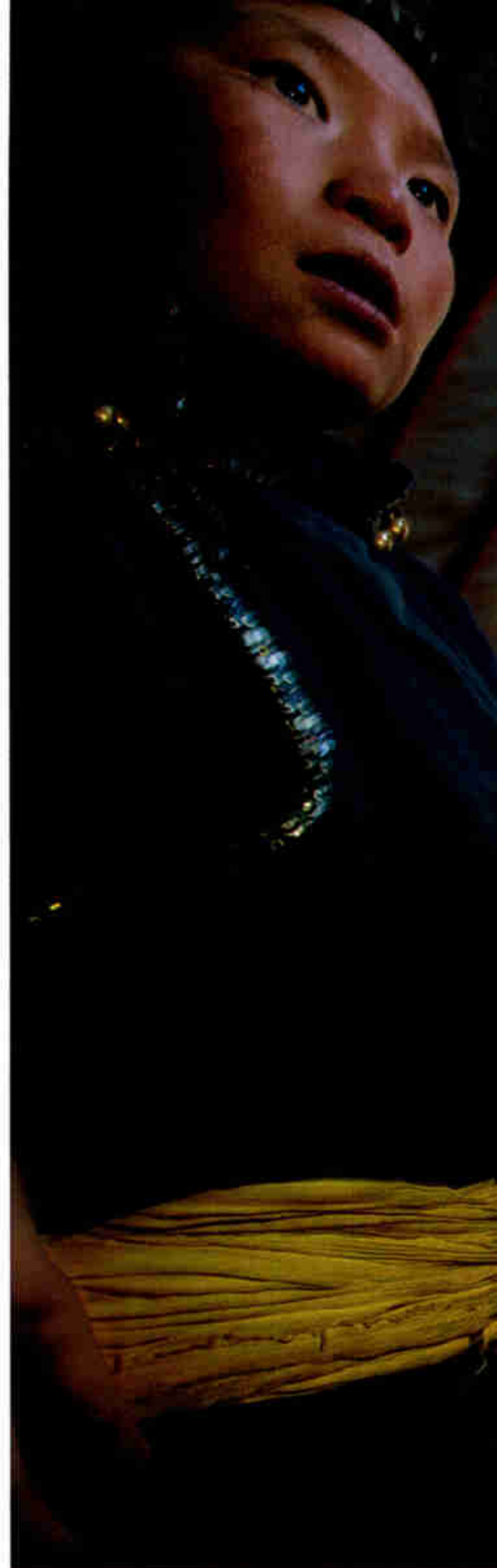
But for some reason, it seems, they've thought better of it and disappeared. Nyamhuu keeps hoping to find them in his sights somewhere on the slopes, but he'll go home without a trophy, and no one's complaining: All 30 horses are present and accounted for. We're lucky. "Every year a few horses get eaten," Davaanyam says.

By the next day the weather has cleared, and Nyamhuu, Achit, Chinbat (our cook and resident card shark), and I decide that we need to head back to the Darhad. By the time the family moves to the winter camp, the weather might be too harsh for us to make the trip back over the mountains. I give the family a fistful of chemical hand and toe warmers for those 40-below January days when they've got to chase down errant horses, and we start riding back.

As we weave through the snow-dusted canyons, Nyamhuu sings Mongolian folk songs and whistles with a warble that reminds me of a Native American flute. "My father was born here, I was too," he sings. "This land is my future. . . ."

A brawny 25-year-old with a wrestler's swagger and an easy laugh, Nyamhuu tells me he loved migrating as a kid. "The migration is a lot of

work, but it's also something to look forward to," he says. "Old people say when they migrate, it lifts their spirits." Nyamhuu met his wife migrating on this very route. But his nomadic days are over. The year he got married his parents gave them 30 cows, and that same year—the dzud winter of 1999-2000—half of them died. He decided he had better options. Now he works as a wrangler for Boojum Expeditions, the American-owned company handling logistics for Gordon, the photographer, and me. Nyamhuu is paid 25,000 tugriks a month—about \$23—plus 2,500 tugriks for each day in the field. "In the countryside it's a big salary," he says. Herders make some cash in the fall selling meat and hides and in the spring selling cashmere from their goats, but they've got to make that last for a year's worth of flour, clothing, and other necessities. "There's no herder with a monthly salary like this."





DINNER WILL BE MUTTON and noodles made from flatbread—today, tomorrow, and the day after. Forget about vegetables. In a land poorly suited to agriculture, people live by the maxim “meat for men, leaves for animals.”

With tourism on a fast uptick in the area, other herders may increasingly be able to follow Nyamhuu's lead. Already two foreign-funded tourist companies have set up shop in the Darhad—Boojum and a Czech-led venture—and three more companies run operations at nearby Lake Hovsgol, which was made a national park in 1992. During a single autumn month in the Darhad I have run into travelers from Switzerland, Israel, Denmark, Italy, South Africa, France, and the United States. Five years ago, this valley was virtually undiscovered.

With no animals to herd, we make it back to Renchinlumbe in a quick two days' ride. There

we have dinner in Nyamhuu's ger, without question the nicest one I've seen, full of new furniture and bright tapestries. The town fires up a diesel generator on winter evenings, so when the electricity comes on at 7:30, so does the new television. With a signal that the post office gets from a satellite and then broadcasts to the town, we watch a terrible Hollywood movie about sorority girls. After many nights on the trail spent playing cards and laughing at each other's jokes, our last two hours together are silent: The TV has the stage. And as I leave, I can't help but wonder whether Nyamhuu's one-year-old daughter will grow up singing the Mongolian songs that

brought such life to the mountains we rode through, or whether she'll grow up lip-synching with whoever happens to be the latest incarnation of Britney Spears.

MY FELLOW COUNTRYMEN, do you see the clouds in the sky? That's where my people are migrating. They're coming through the clouds into happiness.

So wrote Myagmarjav, a local poet, and by the time I'm ready to leave the Darhad I've seen that happiness in many faces. But I've also seen hardships along the migration route. I've seen an old woman inching up the trail on a day of below-zero temperatures, in felt boots with the bottoms falling off, grabbing her hips, moaning "yo, yo, yo, yo"—ouch, ouch, ouch, ouch—following her 11-year-old granddaughter who can't go to school because the family needs her to herd their cattle. I've seen a 78-year-old man fretting because if he dies on the trip he's not sure his daughter and two grandkids can make it without him. I've seen the ravine where a few years ago an old woman on an ox-drawn stretcher almost bled to death when she got flipped over and dragged face first down the trail (the third time she'd cheated death, she later told me). I've heard a rumor that two babies just got frostbite, and I've seen a 72-year-old grandmother nursing bruises on her face after being bucked from her spooked horse. So I understand why Batnasan wants to migrate by truck, and I'm glad when I hear that she and her family have finally arrived safely at their winter camp.

On my last night in the Darhad I go to the house of our local guide, Mishig, with a gift—the knife that has been my constant companion in this world of meat and bone and hide—and a question that I've carried just as close. The governor of this part of the valley until a few years ago, Mishig is the one who told Cliff two summers ago that someone should come document this migration before it disappears. For weeks before the migration started he showed

us the culture of the valley, driving us over rutted truck tracks to introduce us to herders as they made pack bags out of leather and rope out of horsehair and felt out of wool.

WEBSITE EXCLUSIVE

Watch video footage of shamans, horse racing, wrestling, and more—and listen to photographer Gordon Wiltsie's tales at nationalgeographic.com/ngm/0310.



Along the way it became clear that he has a deep connection with this place, and a mutual affection and respect with the people who live here. So when I ask Mishig what he thinks about the fact that the migration as we've seen it will someday end, it's not an incidental question. He's probably given it more thought than anyone.

A Harrison Ford movie is playing on the TV in his two-room house in RENCHINLHUMBE as we talk over boiled mutton and Korean beer. "In town you have warm houses, electricity, television," Mishig says. "When people come into town, they see this life is easier—they're not stupid. You know what I hear young people say all the time? 'I'm becoming an animal slave. I have just one life to live, but I spend it following animals.'

"Someone like you comes to Mongolia and sees how we live and thinks it's romantic, and you want to preserve it. But people who live it



IT'S A LONG, HARD RIDE, but Duujii will make it several times this fall to help shorthanded families move their herds over the mountains. As long as the migration lasts, it will bind people here to the land, the past, and each other.

don't think it's romantic—it's a hard life. If they can buy a truck to do the work of ten oxen—why not? Mongolia gets a third of its money in foreign aid. Do we tell the World Bank that we want to keep our people migrating on oxen?"

It's not quite what I expected him to say. Again and again I've heard him take pride in the culture of the Darhad and lament the erosion of traditional ways. When he has said that he expects people to be migrating by truck 20 years from now, for there to be roads through the mountains and bridges over rivers, I've assumed it was something he didn't want. But I was wrong. He loves the Darhad as it is, but he loves it just as

much for what it can become. And he asked us here to take a snapshot of the moment, like a parent wanting to remember his child at a certain age without wanting her to stop growing.

But when I think back to the night Lhagwaanaa sang to me in Batnasan's ger, I'm glad she hasn't grown out of her nomadic spirit just yet. Before bedtime that night I pulled out a bar of Russian "Titanic" chocolate that I got at a local shop. Lhagwaanaa looked at the wrapper, covered with misty-eyed portraits of the movie's famous lovers, and asked if she could have it.

She wanted to cut it into shapes of goats and sheep. □

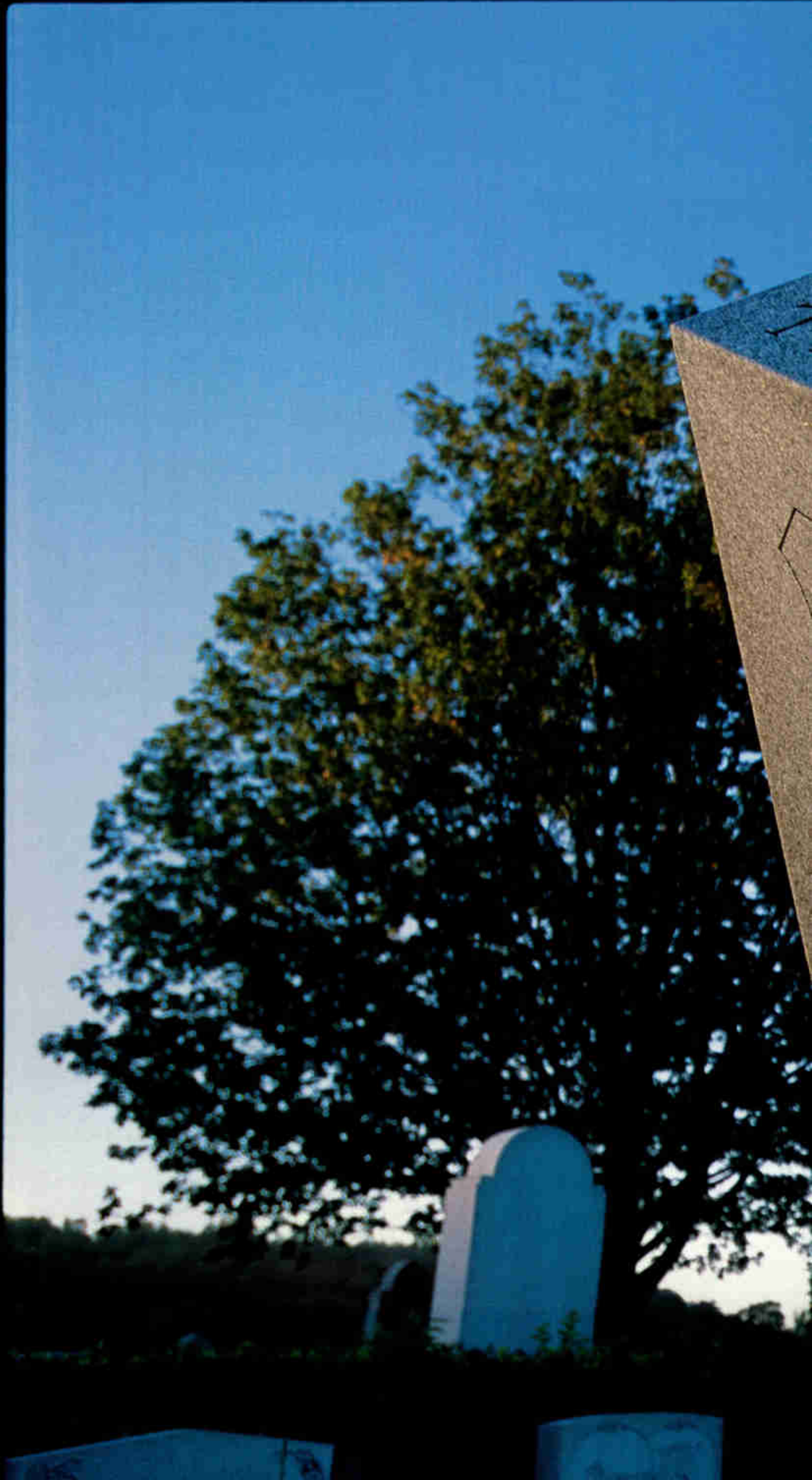
ZipUSA

BARRE, VERMONT

GRAY
PERSONS

05641

People don't always go quietly when they're buried in Barre, Vermont. In this self-proclaimed "granite capital of the world," their tombstones (top) have a flair for the dramatic. The best show in town is at Hope Cemetery (right), where sorrow strikes a balance with civic pride.



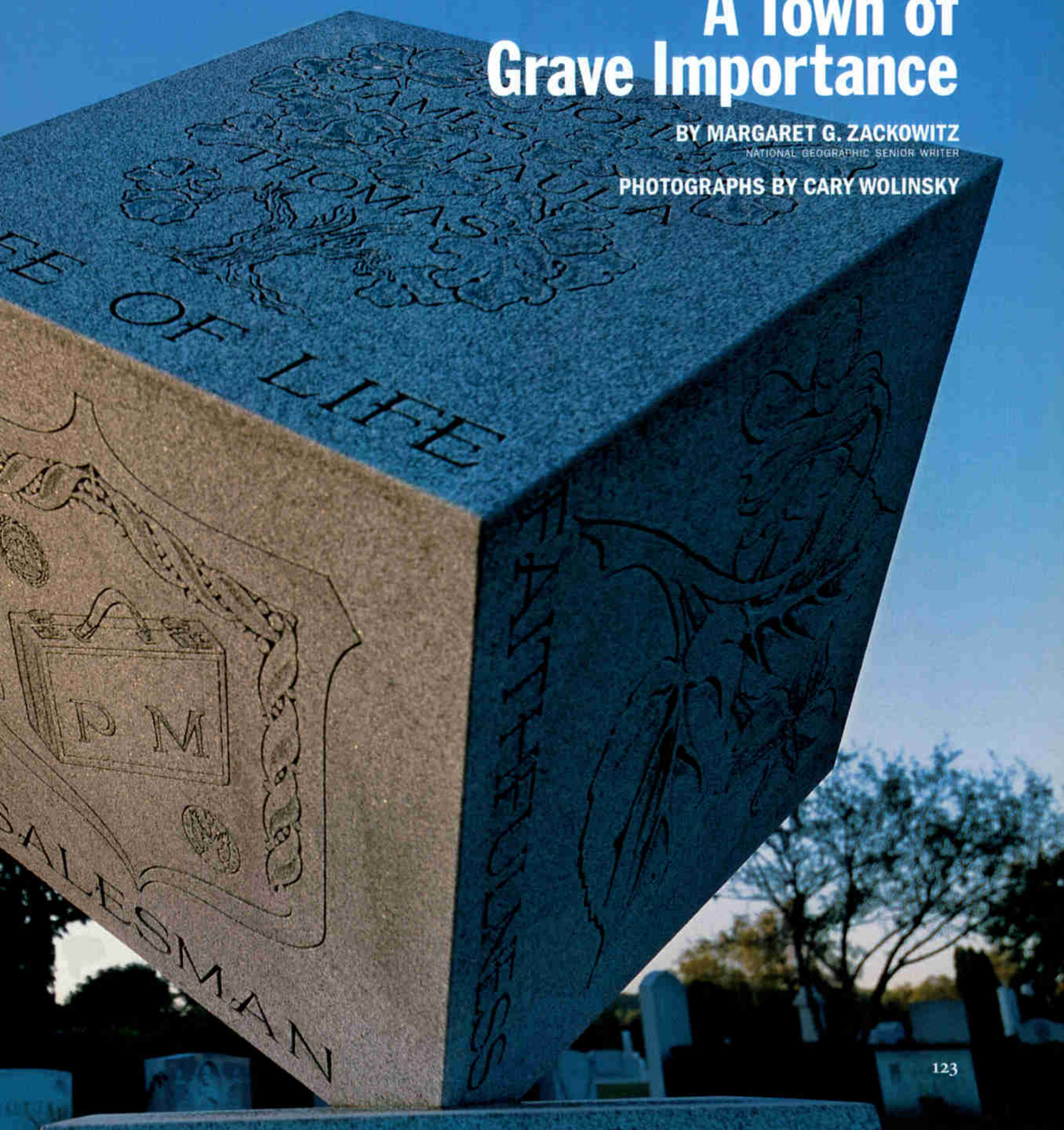


A Town of Grave Importance

BY MARGARET G. ZACKOWITZ

NATIONAL GEOGRAPHIC SENIOR WRITER

PHOTOGRAPHS BY CARY WOLINSKY



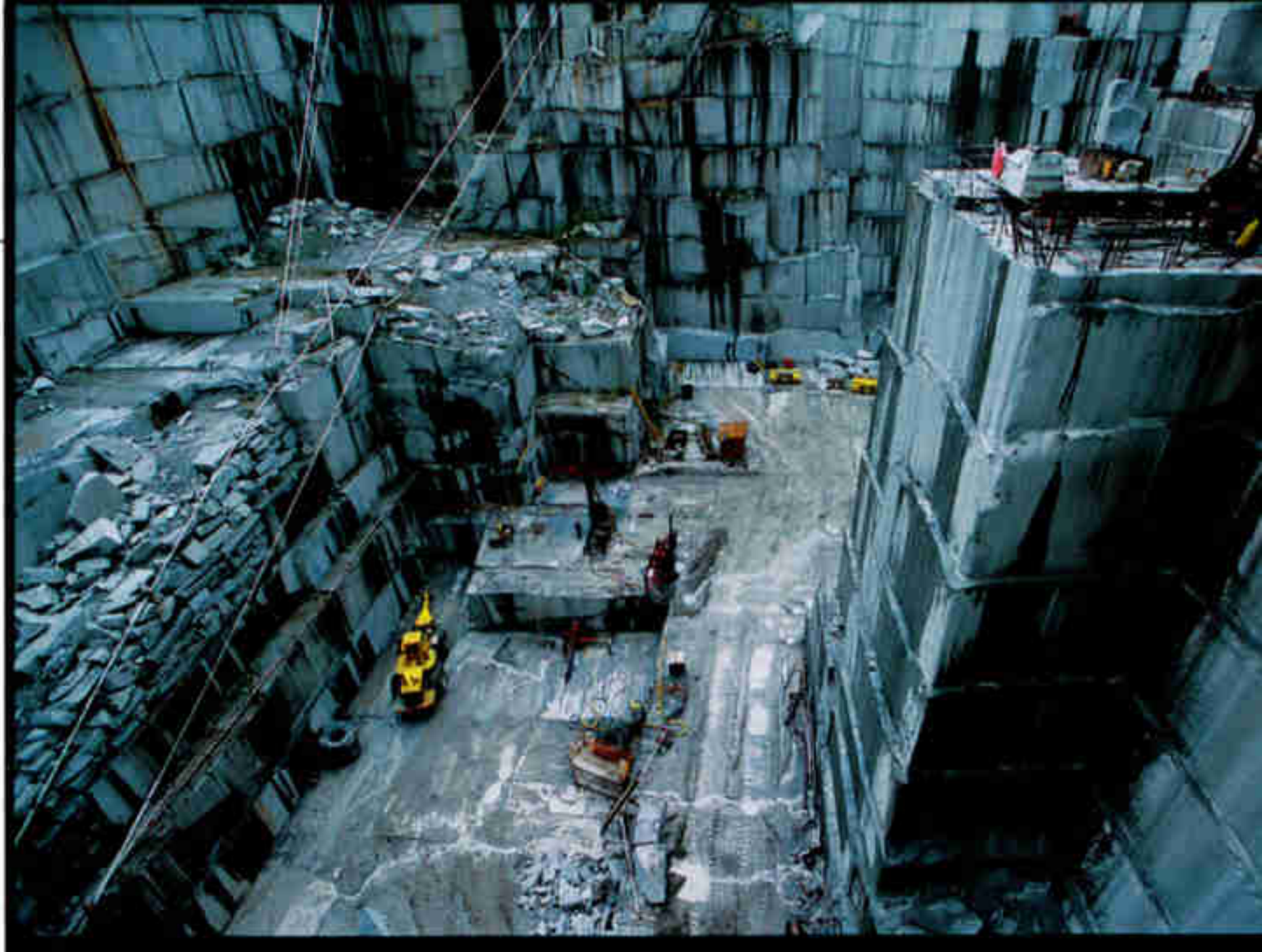
When you're looking at tombstones in Barre, Vermont—and everyone who comes here does—keep an eye out for the ones with carved flowers. They're trying to tell you something.

"A lily with a broken stem means a life cut short," says sculptor Giuliano Cecchinelli, his cap pulled so low that at certain angles the hat itself seems to be the one with the thick Italian accent. He walks quickly; you have to hurry to keep up as he strides between the graves in hilly Hope Cemetery, the city's major tourist attraction. Like many of the men who crafted these memorials—and now rest under them—Cecchinelli, 59, was born and trained in Italy's stonecutting center, Carrara. Every so often he stoops to rub a thumb across some detail on a pale granite grave marker: a curling scroll edge carved parchment thin, an angel's downturned face. Cecchinelli's own work stands over many of the newer burial plots, but most headstones in this section are almost a century old. "Ferns mean the beginning of life. Chrysanthemums mean death. Roses are for love," he says. "And carnations—carnations mean the guy was an anarchist."

Anarchy? In this quaint Vermont setting? It turns out that Barre isn't quite what it appears. (Even the city's name—which local legend claims was chosen by the winner of a fistfight in 1793—isn't pronounced the way it's spelled. You'd better call it "Berry" or risk being asked how the drive was from New Jersey.) The anarchists, who were a political presence here a hundred years ago, have faded into history. But while the city's politics are more conventional now, they remain eccentric. Barre's current mayor, Harry Monti, was elected via a write-in campaign that was a surprise to him: He was in Cancún, on vacation, at the time. The proudly blue-collar city supports the arts; rust-peppered pickup trucks jostled newer cars in the overflowing parking lot of the 1899 Barre Opera House for a recent performance of *Carmen*. But crowds also packed the place for the Miss Vermont pageant last year. You can rent the same stage for your kid's piano recital.

Back when the opera house opened, Barre was a boomtown, "the Chicago of New England," a newspaper called it at the time. In 1890 the population numbered nearly 7,000. By 1903 it was 12,000 and rising. Cutters and carvers from all over Europe arrived to find jobs with Barre's granite quarries and stoneworking sheds. A bustling Little Italy thrived at the city's north end as Italian marble workers came to try their hand at the harder rock. Scots, Irish, Poles, and Spaniards made lives and livings here too.

These days things are quieter. Though 57 stoneworking companies still operate



One of the largest granite quarries on Earth, the E. L. Smith (above) plummets 550 feet deep. Most of its yield of Barre Gray stone is shipped around the world by the Rock of Ages Corporation. But some of it ends up as memorials in Hope Cemetery (below), five miles away.

05641

POPULATION ABOVE GROUND: 9,300

POPULATION BELOW GROUND: 18,500

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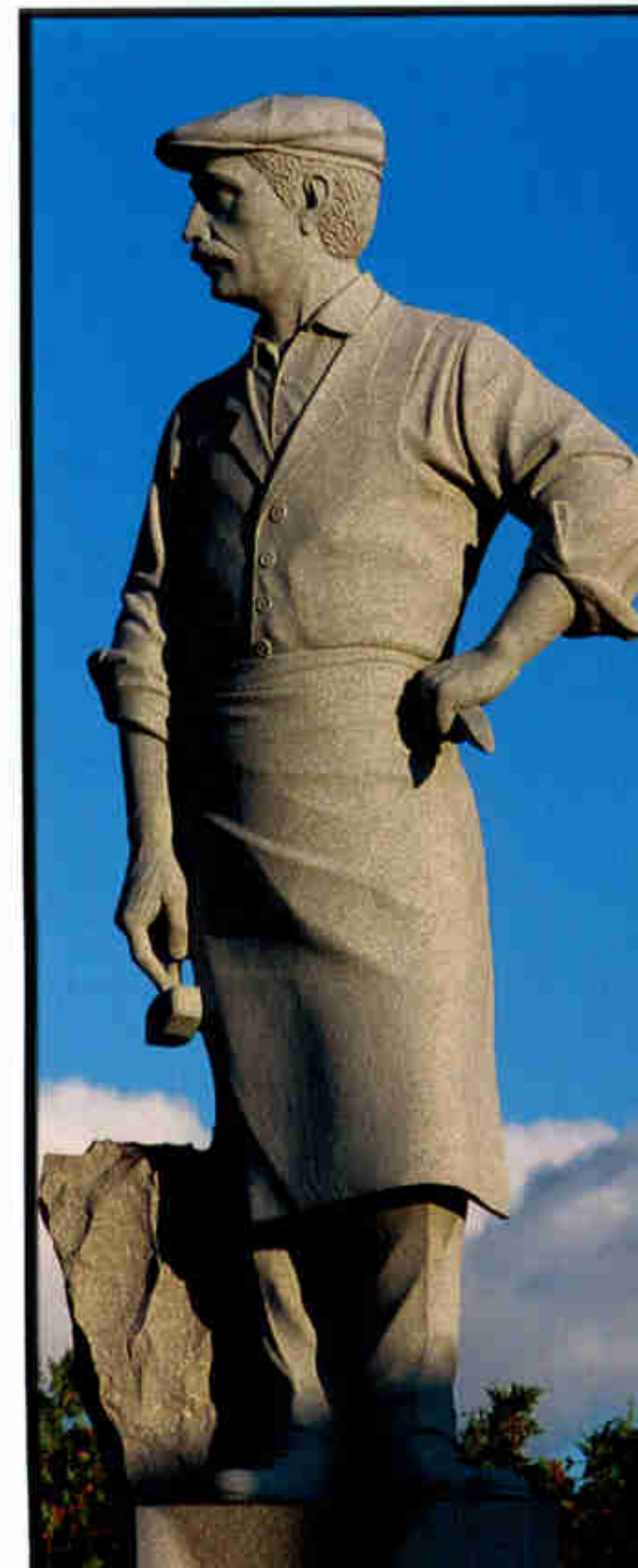


A plaster *pietà* serves as mother to a sturdier version coaxed from stone by Giuliano Cecchinelli (in cap) and son Giuliano Jr. Plastic hoses draw off rock dust. Last of Barre's Italian-born sculptors, the elder Cecchinelli crafted the model for the town's Italian-American stonecutter memorial (below), fondly known as the Italian Stallion.

within city limits, cheap imported granite has reduced demand. Local quarries don't produce—or hire—the way they used to. Barre's population has dropped to just over 9,000. Chain stores outside the city limits have sapped much of Main Street's old commercial diversity: Four pizza shops, three Chinese restaurants, and two florists have sprouted within a one-mile stretch downtown. As Harry Monti's Cadillac negotiates the afternoon traffic jam—an orderly queue of 17 cars, slowed only by drivers' polite stops for jaywalkers—he explains why a little place like this would need two flower shops. “We have,” he says, smiling around his ever present cigarette, “a lot of dead people.”

Barre makes a good living off of death: The boom years may be over, but more granite gravestones are still produced here than almost anywhere else in the United States. Gross sales of world-famous Barre Gray granite topped 11 million dollars last year. And Barre Gray is about the best there is. Fine-grained and impervious to weathering, it can be pulled from the earth here in huge flawless blocks. Street curbs and yuppie kitchen countertops aren't sufficiently noble uses for the stone; this stuff is meant to last the centuries. The steps of the east wing of the U.S. Capitol are made from Barre Gray. So are the grave markers of Stephen Foster, Harry Truman, John D. Rockefeller, Sr., and Col. Harland Sanders. (Does the man who invented Kentucky Fried Chicken deserve anything less?)

Hope Cemetery, where sculptor Giuliano Cecchinelli (and his hat) shows off the flower carvings, is one of three graveyards managed by the city. Only memorials made of Barre Gray are permitted there. Other than that, the options for eternal remembrance are wide open. “We allow bigger monuments than most other cemeteries,” says Dwight Coffrin, whose title, Director of Cemeteries and Parks, seems to list his responsibilities in order of importance to the city. Hope also allows more unusual ones. Along with the usual crosses and cherubs, markers for the 85-acre park's 10,500 graves include an actual-size armchair, an oversize soccer ball, an airplane, a race car, and a massive cube balanced mysteriously on its corner. A number of the stones mark empty graves. The pre-need purchase is common: Many people erect tombstones decades before they die. “That way, you know how you'll be remembered,” explains Coffrin. “People want to enjoy their memorials while they're still alive.” But those paying respects to their own gravesites are far outnumbered come autumn. “This



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cemetery averages 35,000 visitors during the six weeks of the fall foliage season each year, and those are just the ones on tourist buses," Coffrin says. "We don't even keep count for the rest of the year."

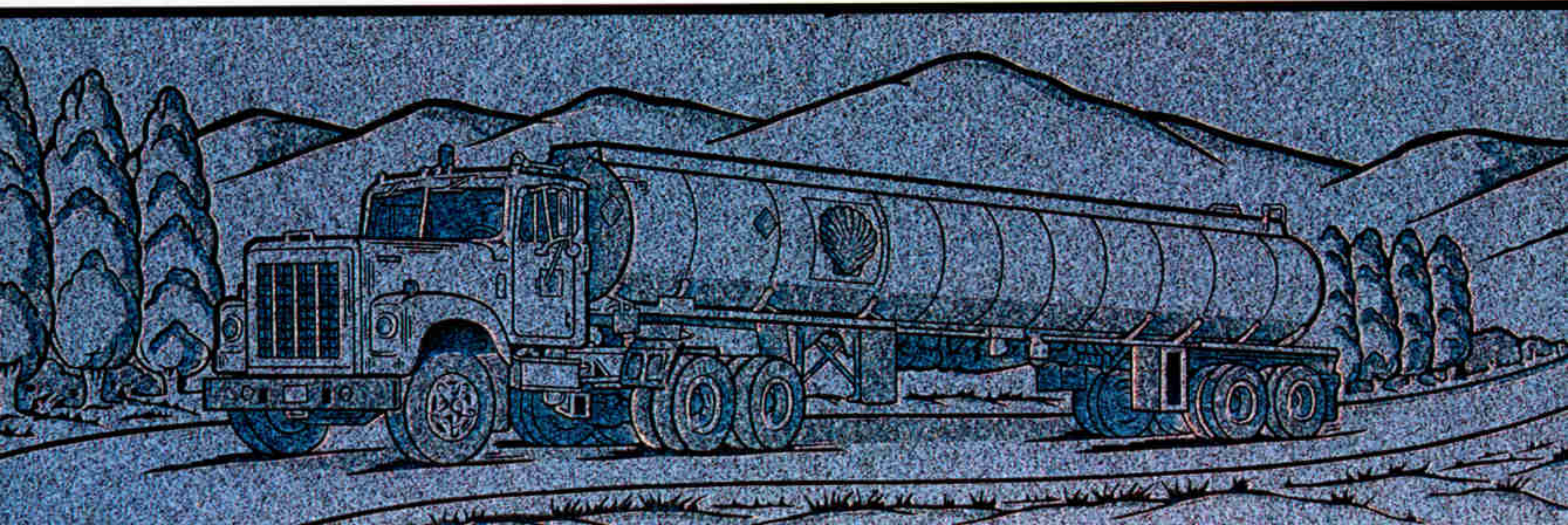
The rest of the year can be a problem in Barre. Despite the city's Green Mountain location, summer temperatures and humidity sometimes soar here, and the winters are numbingly cold. Just ask Pete O'Grady. In September of last year the 33-year city employee resigned as Barre's superintendent of streets to start a new life in Phoenix. The desert held an obvious appeal: O'Grady's job had involved clearing his hometown's roads of its annual average of seven feet of snow. But after only ten weeks away, O'Grady returned to Vermont in November. He'd been miserable in Phoenix. He'd hated the crowds and crime, the traffic and bureaucracy. "Everything's so complicated there," he remembers. "You have to give them your social security number and sign your life away just to get your utilities hooked up. In Barre, whatever you need, you make one call and it's done." O'Grady's former job had not been filled yet, so the city rehired him. The superintendent of streets of Barre, Vermont, picked up right where he'd left off—in time for the season's first blizzard.

"I didn't mind," says the guy who grew up on Granite Street. "It was so good to be home." □

Stone isn't cold when local artists personalize granite to reflect love (above) or a life's work: Natalino Galfetti's marker in Hope Cemetery (below) reflects his truck-driving past. But Nat is still very much alive. Like many in Barre he's just planning ahead.

WEBSITE EXCLUSIVE

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ONE THAT ALMOST GOT AWAY

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MONGOLIAN CROSSING

Have TV, Will Travel

Fascinated by the sight of a satellite dish next to a felt tent, or ger, in Mongolia's Darhad valley, photographer Gordon Wiltsie made arrangements to spend the day with a nomadic herding family and their television (powered by a solar-charged car battery). This moment—a man and boy watching a Mongolian-dubbed Russian movie—was one of the quieter ones. "People from all around came to watch this TV," Gordon says. "I also met a guy who traveled around with a pony cart carrying his VCR, TV, and generator. He'd set up shop in somebody's ger and charge maybe a quarter to play one of the 20 tapes he had."

Gordon thought the picture captured an important facet of life in the valley, but in the end he and the layout team didn't think it fit in with the rest of the photos. "With my camera I was trying to paint a picture of a world that has existed for centuries. I relied on the writer to tell the story of what's changing and what the future might hold."

WEBSITE EXCLUSIVE

Cut it or keep it? Find out more about what tipped the balance for this photo—and zoom in on more images from Mongolia—at nationalgeographic.com/ngm/0310

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MONGOLIAN CROSSING

Back in the Saddle Again

When a writing assignment is also a riding assignment

The Mongolian herders didn't expect much from staff writer **Glenn Hodges**, sent to the Darhad valley to document their migration. As Glenn puts it, "They think if you're a Westerner, you can't do anything useful." But when it came time to get on a horse, the former Kentuckian was ready. He'd supplemented his boyhood summer-camp experience with a few real riding lessons before he left. "It was just enough to make

it look like I knew what I was doing" while galloping after strays, he says. When his shins got rubbed raw by his stirrup straps, Glenn found a piece of rawhide, took some cord and a knife, and—as a skeptical crowd gathered to watch—made a passable pair of chaps. "As everyone drifted away, I said to my translator, 'They didn't think I'd be able to make these, did they?' He shook his head and answered: 'Neither did I.'"

G N M N T

C O V E R I N G T W O R L D





KINKAJOUS

It's Rain Forest—But Not Rain

The kinkajou was creeping toward them. One hundred feet above ground, crouched in the fork of a tree in a Panamanian forest, photographer **Mattias Klum** (above) and his assistant, Lars-Magnus Ejdeholm, squinted through the dark and held their breath as the elusive creature approached.

"We sat in absolute silence waiting to make this fantastic picture," says Mattias. "Soon she was right over our heads, only inches away. We looked straight up in absolute concentration. Then she stops, sits down, and pees all over poor Lars-Magnus's face. I laughed, but he didn't think it was funny."

LARS-MAGNUS EIDEHOLM



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REZA

SAUDI ARABIA

World Watcher

“A lot surprised me about Saudi Arabia,” says **Frank Viviano**—and that in itself is surprising. In his nearly 30 years as a foreign correspondent, Frank has covered the fall

of the Marcos regime and the rise of the post-Soviet states, organized crime in Asia and Europe, and China’s Tiananmen Square protest. For more than a decade, Frank’s main beat has been the Islamic world. Yet Saudi Arabia’s ethnic mix, including Arabs, Africans, Malays, and Filipinos, amazed him, as did

the country’s advanced health care and road system. Enjoying considerable freedom for a Western journalist, Frank was allowed to go nearly anywhere he wanted. Seeing this shot of himself waiting to meet Crown Prince Abdullah bin Abdul Aziz al-Saud, Frank said, “I seem to resemble his predecessors.”

WORLDWIDE

“They don’t use the word ‘grave-stone’ in Barre, Vermont,” says writer **Maggie Zackowitz**. “They say monument or memorial.” At Hope Cemetery, Maggie found that a memorial can say as much about the town’s past as it does about a person’s life. “A row of family graves, all dated the same month in 1918, tells the story of that year’s deadly flu,” she says. “And when you see some amazing stone inscribed with an Italian name and birthplace, it means a stonecutter is buried there. If the dates show he died by age 50, he probably died of silicosis, which he got from breathing the dust of the granite he worked for a living.”

“My whole career has been about finding ways to take pictures in complete darkness,” says **Wes Skiles**. To shoot the bone-strewn underworld of one of Mexico’s cenotes, the veteran cave diver, feigning fright (right), began each ten-hour workday by strapping into a chair harness for a 70-foot dangle down a well shaft into the cave. Challenges in lighting the ballroom-size cavern included climbing Spiderman-style up crumbly walls to hang from its ceiling for the story’s opening shot. “It took four days to set that up,” Wes recalls. Was he afraid of falling? “I was more afraid of the picture not turning out.”



JILL HEINERTH

WEBSITE EXCLUSIVE

Find more stories from our writers and photographers, including their best, worst, and quirkiest experiences, at nationalgeographic.com/ngm/0310.

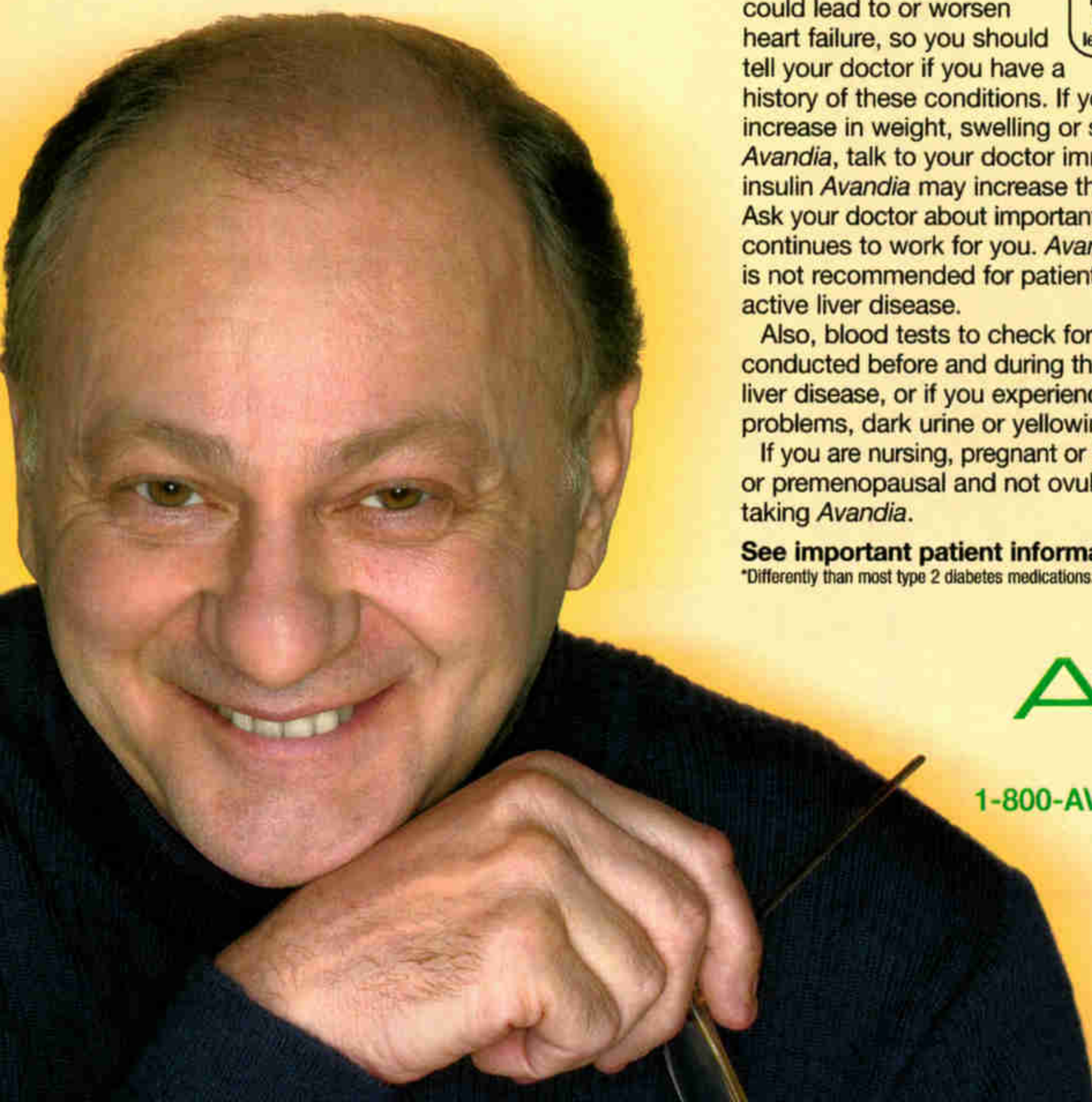
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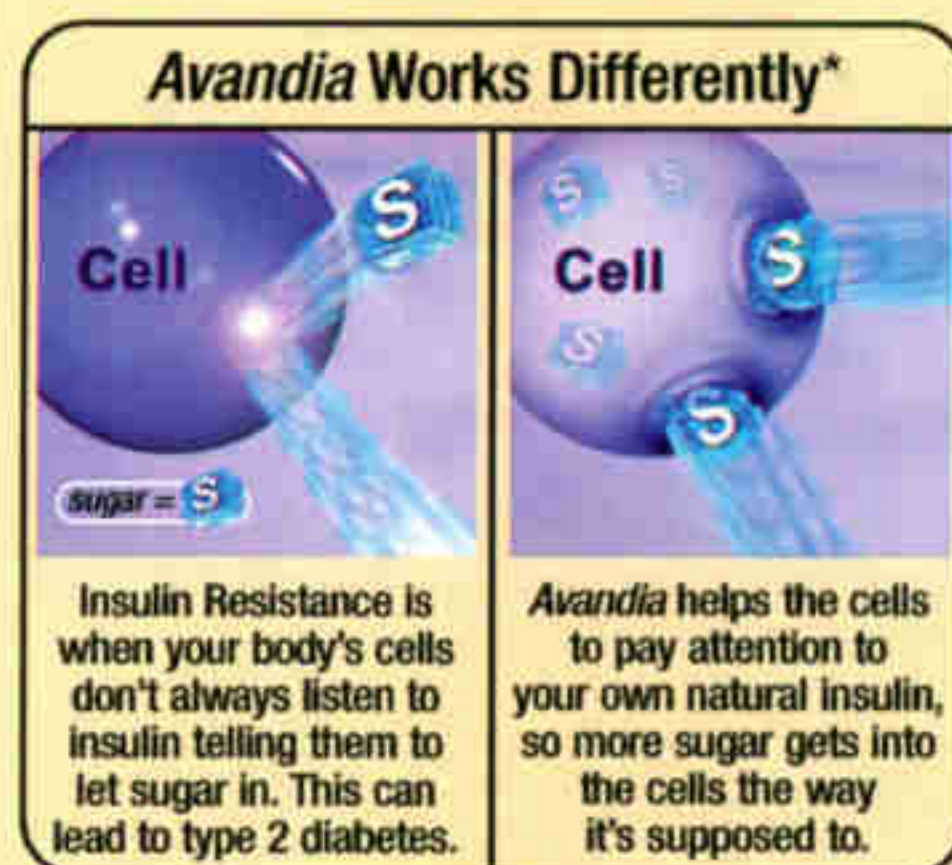
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See important patient information on adjacent page.

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Avandia[®]
rosiglitazone maleate

1-800-AVANDIA www.avandia.com

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**Patient Information about
AVANDIA® (rosiglitazone maleate)
2 mg, 4 mg, and 8 mg Tablets**

What is Avandia?

Avandia is one product in a class of prescription drugs called thiazolidinediones (thigh-a-zol-a-deen-die-owns) or TZDs. It is used to treat type 2 diabetes by helping the body use the insulin that it is already making. *Avandia* comes as pills that can be taken either once a day or twice a day to help improve blood sugar levels.

How does Avandia treat type 2 diabetes?

If you have type 2 diabetes, your body probably still produces insulin but it is not able to use the insulin efficiently. Insulin is needed to allow sugar to be carried from the bloodstream into many cells of the body for energy. If insulin is not being used correctly, sugar does not enter the cells very well and builds up in the blood. If not controlled, the high blood sugar level can lead to serious medical problems, including kidney damage, blindness and amputation.

Avandia helps your body use insulin by making the cells more sensitive to insulin so that the sugar can enter the cell.

How quickly will Avandia begin to work?

Avandia begins to reduce blood sugar levels within 2 weeks. However, since *Avandia* works to address an important underlying cause of type 2 diabetes, insulin resistance, it may take 8 to 12 weeks to see the full effect. If you do not respond adequately to your starting dose of *Avandia*, your physician may increase your daily dose to improve your blood sugar control.

How should I take Avandia?

Your doctor may tell you to take *Avandia* once a day or twice a day (in the morning and evening). It can be taken with or without meals. Food does not affect how *Avandia* works. To help you remember to take *Avandia*, you may want to take it at the same time every day.

What if I miss a dose?

If your doctor has prescribed Avandia for use once a day:

- As soon as you remember your missed dose, take one tablet anytime during the day.
- If you forget and go a whole day without taking a dose, don't try to make it up by adding another dose on the following day. Forget about the missed dose and simply follow your normal schedule.

If your doctor has prescribed Avandia for use twice a day:

- As soon as you remember the missed dose, take one tablet.
- Take the next dose at the normal time on the same day.
- Don't try to make up a missed dose from the day before.
- You should never take three doses on any single day in order to make up for a missed dose the day before.

Do I need to test my blood for sugar while using Avandia?

Yes, you should follow your doctor's instructions about your at-home testing schedule.

Does Avandia cure type 2 diabetes?

Currently there is no cure for diabetes. The only way to reduce the effects of the disease is to maintain good blood sugar control by following your doctor's advice for diet, exercise, weight control, and medication. *Avandia*, alone or in combination with other antidiabetic drugs (i.e., sulfonylureas, metformin, or insulin), may improve these other efforts by helping your body make better use of the insulin it already produces.

Can I take Avandia with other medications?

Avandia has been taken safely by people using other medications, including other antidiabetic medications, birth control pills, warfarin (a blood thinner), Zantac®

(ranitidine, an antiulcer product from GlaxoSmithKline), certain heart medications, and some cholesterol-lowering products. You should discuss with your doctor the most appropriate plan for you. If you are taking prescription or over-the-counter products for your diabetes or for conditions other than diabetes, be sure to tell your doctor. Sometimes a patient who is taking two antidiabetic medications each day can become irritable, lightheaded or excessively tired. Tell your doctor if this occurs; your blood sugar levels may be dropping too low, and the dose of your medication may need to be reduced.

What are the possible side effects of Avandia?

Avandia was generally well tolerated in clinical trials. The most common side effects reported by people taking *Avandia* were upper respiratory infection (cold-like symptoms) and headache. When taking *Avandia* with sulfonylureas or insulin, patients may be at increased risk for low blood sugar. Ask your doctor whether you need to lower your sulfonylurea or insulin dose.

Some people may experience tiredness, weight gain, or swelling with *Avandia*.

Avandia may cause fluid retention or swelling which could lead to or worsen heart failure, so you should tell your doctor if you have a history of these conditions. If you experience an unusually rapid increase in weight, swelling or shortness of breath while taking *Avandia*, talk to your doctor immediately. In combination with insulin, *Avandia* may increase the risk of other heart problems. Ask your doctor about important symptoms and if the combination continues to work for you. *Avandia* is not for everyone. *Avandia* is not recommended for patients with severe heart failure or active liver disease.

Also, blood tests to check for serious liver problems should be conducted before and during therapy. Tell your doctor if you have liver disease, or if you experience unexplained tiredness, stomach problems, dark urine or yellowing of skin while taking *Avandia*.

If you are nursing, pregnant or thinking about becoming pregnant, or premenopausal and not ovulating, talk to your doctor before taking *Avandia*, as *Avandia* may increase your chance of becoming pregnant.

Who should not use Avandia?

You should not take *Avandia* if you are in the later stages of heart failure or if you have active liver disease. The following people should also not take *Avandia*: People with type 1 diabetes, people who experienced yellowing of the skin with Rezulin® (troglitazone, Parke-Davis), people who are allergic to *Avandia* or any of its components and people with diabetic ketoacidosis.

Why are laboratory tests recommended?

Your doctor may conduct blood tests to measure your blood sugar control. Blood tests to check for serious liver problems should be conducted before starting *Avandia*, every 2 months during the first year, and periodically thereafter.

It is important that you call your doctor immediately if you experience unexplained symptoms of nausea, vomiting, stomach pain, tiredness, anorexia, dark urine, or yellowing of the skin.

How should I store Avandia?

Avandia should be stored at room temperature in a child-proof container out of the reach of children. Store *Avandia* in its original container.





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FROM OUR ARCHIVES

Flashback



ORIENTAL INSTITUTE, UNIVERSITY OF CHICAGO

IRAQ'S TREASURES

What a Relief

During the late eighth century B.C., it watched over a gate of King Sargon II's palace at Dur Sharrukin, now Khorsabad, Iraq. But this gypsum relief of a winged Assyrian god eventually went underground—buried beneath centuries of dirt after the king died and Dur Sharrukin was abandoned. An archaeological team from the University of Chicago's Oriental Institute finally uncovered the carving during the 1933-34 excavations at the site (above). Though other Khorsabad finds were shipped to Chicago, this god never flew far from home and has long been displayed at Baghdad's Iraq Museum. Perhaps the ancient deity still holds a few of its old powers of protection: It remained unharmed during last April's looting of the museum's treasures.

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